OBSERVATIONS
ON THE
BILE AND ITS DISEASES,
AND ON THE
ŒCONOMY OF THE LIVER;
READ AT THE
ROYAL COLLEGE OF PHYSICIANS,
AS THE
GULSTONIAN LECTURE
OF THE YEAR 1799.

BY
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1800.

TO

SIR LUCAS PEPYS, BART. M.D.

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS,

PHYSICIAN TO THE KING,

AND

PHYSICIAN GENERAL TO THE ARMY;

THE FOLLOWING

LECTURES

ARE INSCRIBED,

AS A

TESTIMONY OF RESPECT

FOR HIS

PROFESSIONAL AND PUBLIC CHARACTER,

AND OF

GRATITUDE FOR FAVORS CONFERRED UPON

THEIR AUTHOR.

ESSEX-STREET, STRAND,
JULY 1, 1800.

IT is neceſſary to mention that the following pages were printed in April laſt, and that they have been detained thus long in daily expectation of receiving from the engraver two colored plates, whoſe references are given at the end. The drawings were delivered to Mr. Hinton for this purpoſe in January, under a verbal agreement that they would be ready in two months, but it was not till the end of December that one hundred of the finiſhed copies were brought to the publiſher. For theſe the charge is ſo enormous, and ſo much beyond the expectations founded on his ſtatement to me, that I feel it a duty not to impoſe it upon the public, but to ſtop any farther impreſſion for the preſent. It is probable that our ſettlement will not be very ſpeedily made; when it takes place the plates ſhall be added to an Appendix, and their price ſhall not exceed what is paid for them to the engraver.

R. P.

Eſſex-ſtreet,
January 6, 1801.

OBSERVATIONS

ON THE

BILE, &c.

Every claſs of animated beings which has been examined, even thoſe inſects whoſe minuteneſs requires the aſſiſtance of a microſcope to diſcriminate their ſeveral parts, poſſeſſes a liver, or ſomething which has ſtruck anatomiſts as analogous to it. Its bulk in the human ſubject, and the various diſeaſes to which it is liable, give a ſtill greater degree of intereſt to the conſideration of a part of ſuch univerſality and importance. It is my intention to treat of its phyſiology and ſome parts of its pathology, uſing the liberty of enlarging upon thoſe particular points in each of theſe, which I conceive capable of farther elucidation, and if I ſhall appear to differ from opinions which have been ſanctioned by time and authority, I truſt the diſſent, even if it be thought unfounded, will not be conſidered as frivolous, or as ariſing merely from a love of novelty and change, but rather as dictated by an honeſt zeal for the enlargement of our profeſſional means of alleviating the calamities of human nature.

The glandular maſs called the liver is, in the human adult, the largeſt in ſize of all the abdominal viſcera. The irregularities of its ſhape ſcarcely allow of compariſon with any definite figure, it may perhaps, in its general outline, be thought to bear a nearer reſemblance to a cone, divided longitudinally, than any other, the baſe of which occupies the whole of the right hypochondriac region, and it gradually diminiſhes in bulk as it ſtretches acroſs the epigaſtric, till it reaches its apex in the left hypochondrium. It is by the irregularities of its form, accommodated, and as it were moulded, to the parts with which it lies in contact. Its ſuperior ſurface has a regular and unbroken convexity of ſhape, and is cloſely applied, through the whole of its extent, to the arch of the diaphragm, with which it is connected by three duplicatures of the peritonæum, called ligaments; the central and chief of theſe runs entirely acroſs its ſurface, and contains, in its anterior part, the ligamentous remains of the veſſels which carried on the fœtal circulation; the courſe of the ligament divides this ſurface unequally into what are called the right, or greater, and the left, or leſſer, lobes. The inferior ſurface has alſo a ſimilar diviſion, formed by the inſertion of the fœtal veſſels, which are continued in a deeply indented groove, till they reach the vena cava aſcendens; its outline is more irregular than that of the upper, and is varied by a number of unequal eminences and depreſſions. Some of theſe ſeem only intended to accommodate the neighbouring viſcera;

thus, in the right diviſion, there are two ſlight depreſſions, one of which anſwers to the ſituation of the tranſverſe arch of the colon, and the other, to that of the ſuperior part of the right kidney; and in the left diviſion there is one ſuperficial, but extenſive, excavation for the reception of the ſurface of the ſtomach: in the ſame way the hinder edge gives a paſſage to the vena cava, and waves round the projecting column of the ſpine; and the anterior forms an acutely indented fiſſure, where the ſuſpenſory ligament paſſes beneath it. Other depreſſions are intended for the reception of parts neceſſary to its own œconomy; ſuch is that excavation, formed by the horizontal fiſſure, and another, which interſects it at right angles, called the tranſverſe, in the depth of which, enveloped by the cellular membrane, which forms the capſule of Gliſſon, lie the ſinus of the vena portæ, and the trunks of the ſeveral veſſels and nerves by which the liver is ſupplied, and its ſecreted fluid carried away. To two of the eminences, formed by the projecting ſubſtance of the liver at this point of interſection of the fiſſures, has the name of portæ been given, and the outer of theſe, which projects fartheſt in a widening triangular ſhape, forms the lobe of Spigelius. Behind theſe portæ, in a deep groove, runs the vena cava aſcendens, and before it quits the viſcus, in its paſſage upwards to the tendinous part of the diaphragm, receives the blood from the trunks of the collected branches of the hepatic veins.

In the anterior part of the horizontal fiſſure, in a depreſſion, which is hollowed out for the reception of one of its ſides, lies the gall bladder, a pear ſhaped, oblong, muſcular, highly vaſcular, and glandular bag, uſually of about the ſize of a hen's egg. Its obtuſe end projects ſomewhat forward, beyond the edge of the liver itſelf, the point from which its duct ariſes being directed backwards, with a double curve, to the general receptacle of the hepatic veſſels.

The muſcularity of this bladder has been queſtioned, upon the ground that no fibres reſembling muſcle are demonſtrable on diſſection. All its ordinary functions might, perhaps, be ſuppoſed to be carried on from extraneous cauſes, ſuch as the motion of the liver upon the other inteſtines during the alternate contraction and dilation of the diaphragm and abdominal muſcles, and the variable degree of tenſion from repletion, of which the neighbouring viſcera are ſuſceptible; but, in ſome caſes, theſe extraneous powers do not produce its evacuation, though they ſubſiſt in their full force; and, in others, where irritating cauſes, ſuch as concretions, have been preſent, it has been found contracted on either ſide them, and forming a permanent ſtricture; it does, therefore, appear to poſſeſs that contractility which implies the exiſtence of muſcular fibre as its cauſe.

Suppoſing then the exiſtence of a muſcular coat, the gall bladder poſſeſſes two others, one which is external to it, and membranous; and another, which is internal, and which, from its general appearance, would lead us to imagine that it performs ſome more important office than that of a reſervoir only. It is highly vaſcular and rugous, with folds, which project inwards, ſo as to build up a reticulated ſurface, and thus bears a cloſe reſemblance to the ſtructure of the interior coat of the ſtomach, which we know certainly to be a copiouſly ſecreting organ.

Many authors* have alſo demonſtrated the exiſtence of numerous ſmall glands, ſituated in the cellular membrane, immediately under the internal coat, and abounding moſt near to the neck of the bladder: that theſe are not always to be diſcovered is no objection to their exiſtence, and it is probable, that where they have been readily found, there has been ſome enlargement of their ſize from diſeaſe.

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* Ruyſch, Ep. 5. Bianchi Hiſt. Hepat. Vol. II. p. 978. Vicq. d'Azyr, Mem. Par. Vol. II. p. 255.

The liver, in common with other glandular parts, is furniſhed with an abundant ſupply of arteries, veins, nerves, and abſorbents; it has alſo the vena portæ and biliary ducts, which are peculiar to itſelf.

The artery from which its chief ſupply is drawn is called hepatic; its moſt common origin is from the cæliac, but it has occaſionally been found to ariſe directly from the aorta, between the cæliac and meſenteric. After having given off ſmall branches to thoſe parts which lie in the neighbourhood of its courſe, it enters the capſule of Gliſſon, with the vena portæ, and then, dividing into two large branches, ramifies with it through the whole ſtructure of the liver. Beſides the great trunk, there are alſo ſmaller branches ſent to this viſcus from the larger coronary artery of the ſtomach, from the trunk of the meſenteric, and others, of ſtill leſs ſize, from the mammary, phrenic, capſular and renal. From the hepatic artery ariſes a branch which ſupplies the gall bladder.

The hepatic veins, collecting themſelves from all parts of the ſubſtance, are, at laſt, inſerted by a varying number of trunks, of which two or three conſiderably exceed the reſt in ſize, into the vena cava, where it paſſes behind the poſterior margin of the liver. The veins of the gall bladder diſcharge their contents into the vena portæ.

The nerves accompany the hepatic artery through all its ramifications; they are principally derived from the plexus ſolaris, which is itſelf formed of fibres, which come from the inferior part of the ſemilunar ganglion; they arrange themſelves around the artery, forming a kind of net work, and conſtitute the hepatic plexus; from hence fibres ariſe, ſome of which attend the veſſels through the whole ſubſtance of the liver, whilſt others run to the gall bladder, and alſo with thoſe branches of the hepatic artery, which go to the great curvature of the ſtomach, and other neighbouring parts.

The abſorbent veſſels of the liver have been traced with great minuteneſs, and in much greater abundance than thoſe of any other viſcus, on account of the numerous communications between their ſeveral branches, and the relative facility with which injections paſs into them, for it not unfrequently happens that, in this particular organ, they will run from the trunks of theſe veſſels into their branches. They have been divided into the ſuperficial and deep ſeated; of the former, ſome bend their courſe towards the ſuſpenſory ligament, and others to the right and left ligaments, where their trunks paſs through the diaphragm, at either point, and all ultimately reach certain glands, ſituated on the anterior part of the pericardium, and theſe ſend off one large trunk, which commonly joins the thoracic duct, near to its termination. On the under ſurface they are moſt evident near the fundus of the gall bladder, and all of them run irregularly towards the glands, which ſurround the trunk of the vena portæ; and laſtly, communicate with the thoracic duct, by directing their courſe towards it, behind the pancreas. The abſorbents of the interior accompany the branches of the other veſſels, and alſo run to the glands, which are ſituated round the vena portæ, and from thence to the thoracic duct, which they reach near the origin of the ſuperior meſenteric artery. The whole ſeries, whether ſuperficial or internal, appear to be connected together by numerous anaſtomoſes.

Next with reſpect to the veſſels peculiar to the liver.

The vena portæ collects all the blood, which has paſſed through the arteries of the abdominal viſcera, into one trunk, which is formed immediately by the junction of the ſplenic meſenteric and gaſtric veins; it enters the tranſverſe fiſſure of the liver between the projecting portæ, from which it is named, when it divides into two large branches, which run at right angles to each other; theſe ſubdivide again, and ramify, in

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a decreaſing ſeries, through the whole ſubſtance, like arteries, affording the only inſtance in the body in which a vein divides into branches, after having once united to form a trunk in its courſe towards the heart. Like the veins of the other viſcera, the vena portæ has no valves; this, therefore, does not conſtitute any peculiarity in its ſtructure, or bring it nearer to the ſtate of an artery than thoſe of the brain, or lungs, or kidneys. It ſeems more looſely attached to the ſubſtance of the viſcus than the hepatic veins, and, therefore, collapſes more when cut through; partly by this circumſtance, but more eſpecially by the different direction in which its branches run, it is diſtinguiſhable from the hepatic veins.

The biliary ducts anſwer as excretories to the liver, collecting the fluid, ſecreted by the extremities of the other veſſels, from each branch of which a correſpondent biliary canal uniformly ariſes. Theſe unite gradually to each other, till they emerge from the ſubſtance of the liver, into the large fiſſure, in two or three trunks, which immediately unite into one, and the duct thus formed, runs, included in one common capſule, with the hepatic artery and vena portæ, and keeps a ſtraight courſe towards the duodenum, under the name of hepatic duct. After ſome progreſs the duct of the gall bladder is inſerted into it at an obtuſe angle, after which, it paſſes on till it has reached the duodenum, between the coats of which it runs obliquely, for a ſhort diſtance, before it opens into the cavity of that inteſtine, which it does at ſome diſtance from the pylorus, where the gut forms a curve before the right kidney. Previous to its opening, the mouth of the duct has moſt commonly united with that of the pancreas, but ſometimes they are ſeparate, though cloſely in contact with each other. At the point of their entrance they project within the gut, ſo as to form a diſtinct tuberculated point, which is very ſenſible to the touch.

The ſtructure of the hepatic and common duct appears to be entirely membranous, with a number of viſible perforations, which probably ſecrete a mucous matter, for its own defence, from the contact of the fluid it conveys; whilſt that of the cyſtic duct is reticulated by projecting folds, through the whole of its length, like the internal coat of the bladder itſelf. As then this difference between the hepatic and common, and the cyſtic duct, ſubſiſts, the latter ought rather to be conſidered as a part of that bladder, participating in all its functions, and contributing to whatever change is there produced upon the bile, than as a ſimple canal of communication between it and the general duct.

Of theſe veſſels, connected together by cellular ſubſtance, is the maſs of the liver built up, the connection ſeems, at their extremities, to be more intimate, and leſs eaſily deſtroyed, than in any other part of their courſe, giving, at thoſe extremities, the appearance of ſmall lobes, or acini, as they have been called. This opinion of the more minute ſtructure of the liver, has alſo been ſtrengthened by the general form it bears in animals, which require much motion of the ſpine, for the purpoſes of their œconomy, as in the cat kind, where the liver is evidently compoſed of a number of diſtinct lobes. Obſervations, however, upon the minutiæ of anatomy, even when aided by the powers of the microſcope, are ſo fallacious, as rarely to deſerve more than the name of ſpeculations; it is probable that, in the extreme branches of all ſecreting veſſels, there is ſome peculiarity of ſtructure, by which they are enabled to produce ſuch ſtriking changes in the circulating blood; but theſe powers ſeem rather to depend upon, and be connected with, the exerciſe of the principle of life, than any mechanical difference in their form of veſſels.

With reſpect to the relation which theſe ſeveral ſets of veſſels bear to each other, injections ſeem to prove the exiſtence of a general and mutual communication between them, ſo that if water be forced into the trunk of any one, it will return by the trunks of the others. What is the nature of theſe communications we know not, or whether they exiſt at all thus generally in the living body; it is certain, if they do, that their ſeries of actions is well eſtabliſhed, and it does not appear to be even in the power of diſeaſe to invert any of them.

The liver, like the other abdominal viſcera, lies externally to the peritoneal bag, and protruding into it, receives over by much its greateſt part, a general covering of that membrane, accommodated by its flexure to the general ſhape of the viſcus and its appendages, and cloſely attached to them. The peritonæum too, as it is reflected from the diaphragm and parietes of the abdomen in order to reach the liver, forms, by its duplicatures, the ſeveral ligaments by which the maſs is ſuſpended.

The ſize of the liver in adults admits of conſiderable difference, without any alteration of its ſtructure from diſeaſe; at a medium its ordinary weight may be eſtimated at about three pounds, or ſomewhat more: but the variations of its weight and relative bulk are, in many caſes of diſeaſe, moſt ſtriking; I have ſeen a liver weighing little ſhort of forty pounds. This increaſe may be connected either with a more firm and denſe, or with a more lax and ſpongy ſtate of its ſubſtance, ſo that the weight does not always bear the ſame relation to the ſize. Sometimes its natural bulk is diminiſhed, though this alteration is uncommon, and is always attended with increaſe of hardneſs.

As the liver is intimately attached to the diaphragm, ſo it is, in ſome degree, influenced by its alternate contractions and dilatations, and, on this account, its relative ſituation to the external parts of the body admits of ſome variation; ordinarily, however, its anterior edge has that of the ribs for its boundary, and does not deſcend lower. As it reſts alſo upon the ſtomach and colon, its ſituation is ſomewhat affected by the ſtate of their cavities; if, from any cauſe, they be much diſtended, the liver is elevated, the free deſcent of the diaphragm is impeded, and the breathing becomes difficult in proportion; where, on the contrary, the inteſtinal canal is empty, a part of its wonted ſupport is withdrawn, and the diaphragm is, as it were, dragged downwards, by its dependence on the ſuſpenſory ligaments attached to it.

The ſituation of the liver appears alſo to be ſuſceptible of alteration from other poſitions of the body, and to be conſiderably regulated by the gravitation of ſo large a maſs. In an upright poſition it deſcends loweſt; when lying on the back, the curve of the ſpine forms an inclined plane, and it ſlides along it, receding from the edge of the ribs, and preſſing againſt the diaphragm. This unfavourable poſture is generally choſen for external manual examination of the liver, nor is it alone unfavourable by removing the object of ſearch farther from our reach, but it is alſo connected with a tenſion of the abdominal muſcles, affording, by their reſiſtance, another impediment to the examination of the ſubjacent parts. It has always appeared to me much better to have the patient ſtanding, with a little flexion of the body forwards, and by giving him a ſupport to prevent the poſture from being occaſioned by contraction of the abdominal muſcles. This aſſiſts the gravitation of the liver towards the point where the hand is to be applied, and, under theſe circumſtances, the edge can moſtly be felt, and a tolerable judgment formed reſpecting it, unleſs the thickneſs of the integuments be much increaſed by fat; but in every caſe I have always fancied that any general affection is beſt diſcovered in the epigaſtric region, where the tendinous expanſion of the diaphragm affords more reſiſtance from behind, and where, as it croſſes that region, it is not covered by the ribs.

In the fœtus the liver is the firſt formed of all the abdominal viſcera, and has attained conſiderable ſize before the ſtomach, inteſtines, kidneys, or even the lungs are viſible*. It alſo differs more in its ſtructure, form, and ſize, from that of the adult than any other viſcus of the body. It is proportionably much larger, and chiefly in its left lobe, for it ſtretches ſo far into the left hypochondrium, that the ſuſpenſory ligament makes nearly an equal diviſion of its ſubſtance, and it occupies the greater part of the whole cavity of the abdomen. In its healthy ſtate it has alſo a darker colour. Independent of its ſupply of blood from the veſſels which have been mentioned, it receives a large quantity from another ſource, through the umbilical vein, and is the medium through which moſt of the blood paſſes which flows from the placenta to the fœtus. In this diſtribution does one great peculiarity of the fœtal circulation conſiſt. The umbilical vein ariſes from the collected branches of the placenta, and enters the fœtus at the navel, it runs incloſed within a thick ſheath, which afterwards forms the lower part of the ſuſpenſory ligament, to the horizontal fiſſure, where it gives off ſome branches on either ſide to the ſubſtance of the liver; of theſe the moſt numerous and largeſt run to the left, they ramify chiefly in the inferior part, and at laſt unite to the extremities of the hepatic veins. When the great trunk has reached the hollow, formed by the conflux of the two fiſſures, it gives off two conſiderable branches, and then terminates ſomewhat abruptly, in a rounded projecting point. One of theſe, named ductus venoſus, runs along the horizontal fiſſure, and, dilating conſiderably, unites with the left trunk of the hepatic vein, into one large canal, which enters the vena cava juſt below the diaphragm. The other, ſoon after its origin, joins the vena portæ, forming a large, but ſhort, canal, and, in common with the blood collected by that vein from the abdominal viſcera, the placental blood is diſtributed through the liver, and, after being again collected by the hepatic veins, is diſcharged into the vena cava.

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* Haller Formation du Poulet, p. 123.

When the connection between the child and its mother is broken, and it has become an independent being, the neceſſity for the peculiar veſſels, which have miniſtered to that connection, no longer ſubſiſts, even the trunk of the umbilical vein is gradually obliterated as well as its dependencies. I do not however mean to ſtate the perfect obliteration of that trunk as even a common occurrence, for, in moſt inſtances, it will, in the adult, admit of the paſſage of a probe: but it is impervious to the circulating blood, and ordinarily contains none of it, though the time at which it becomes ſo is by no means conſtant. In moſt caſes it begins to cloſe ſoon after the birth of the infant, and to aſſume the appearance, as well as office, of a ligament; but it has occaſionally happened that the umbilical vein has been found open, as far as the navel, and filled with blood from the vena portæ, in ſubjects of very advanced ages. At about the age of five years, and not before, the liver has loſt its fœtal characters entirely, the whole occupies leſs relative ſpace, the left lobe bears a diminiſhed proportion to the right, and it has the uſual appearances of this viſcus in adults.

One of the grand purpoſes of the liver, in the animal œconomy, is the ſecretion of that fluid called bile.

Before, however, the properties of bile are conſidered, it is matter of great phyſiological importance to endeavour to aſcertain from the extreme branches of which of the veſſels, carrying blood to the liver, the hepatic artery, or the vena portæ, this particular fluid is ſecreted; and the more ſo, becauſe it ſeems to me, that the common opinion is not ſo well eſtabliſhed as to make any objection to it preſumptuous.

The higheſt authorities, ſince the diſcovery of Harvey, which deſtroyed the ideas of the antients, reſpecting the importance of the liver to the motion of the blood, have given this office to the vena portæ, and the following are the chief arguments upon which they have reſted this opinion. That no other idea can ſufficiently explain the peculiar diſtribution of the vena portæ through the liver, differing as it does, in the ramifications of its trunk towards the heart, from every other vein in the body. That the diſtribution of its extreme branches, when they are injected, reſembles the diſtribution of thoſe arteries which are known to be ſecretory. That no other reaſon can be given why a branch of vena portæ ſhould ſo conſtantly, and uniformly, accompany a branch of the biliary duct. That the venal blood, as it returns from the inteſtines, the veins of which unite to form the vena portæ, is neceſſarily loaded with acrid and oily particles, and, therefore, is more particularly ſuited to the ſecretion of, what was thought to be, the moſt acrid and oily fluid of the whole body. That there is not the uſual relation of ſize between the branches of the hepatic artery and the biliary duct, and that if this artery formed the bile there would not have exiſted ducts, for the reception of the ſecreted fluid, of a larger capacity than the whole of the ſecreting artery, while the branches of vena portæ are larger than thoſe of the biliary duct, and thus ſtand to them in the uſual relation; and, laſtly, that Malpighi performed the experimentum crucis by tying up the hepatic artery of a living animal, and finding that the ſecretion of bile was not interrupted *.

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* In brutis ligata arteria hepatica prope truncum cœliacæ, laceratoque bilis folliculo vel etiam avulſis ejuſdem tunicis coercitoque pancreatis vaſe, ſuperſtite per diem animalis vita, per portam in jecur irruente ſanguine, bilis ingens copia e poro biliario & choledocho in duodenum tranſducta colligitur, quæ colore nequaquam conſimili pollet cum dilutior ſit, nec tantum lentoris & amaritiei obtinet

The whole of theſe arguments, except the laſt, are to be conſidered as inferences from analogy rather than from actual experiment; and that of Malpighi appears, on conſideration, very unſatisfactory and indeciſive, for though he did cut off the ſource of its arterial blood from the liver, he could not exhauſt the veſſels, ramifying through its ſubſtance, which were previouſly filled with it, nor could he clear away the bile already formed in the viſcus, or aſcertain what portion of that he afterwards found was ſecreted before the performance of his operation, unleſs his animal had lived a much longer time than a ſingle day after it: I think, moreover, that the other ſtatements, reſpecting the peculiar diſtribution, will admit of another, and that a probable, explanation, and that, as far as relative ſize goes, it is by no means impoſſible

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quantum paſſim bilis veſicæ poſſidet, & ſi igne vel alio conſimili exagitetur vehementiſſimum exhalat odorem aliaque longe diverſa a cyſticæ bilis natura patitur. Malpighi de Liene. p. 120.

for the hepatic artery to anſwer the purpoſe of biliary ſecretion. From the general influence of ſome prevalent theory upon medical opinions, and the plauſibility with which that of the Boerhaavian ſchool reduced the actions of the animal œconomy to the reach of vulgar comprehenſion; I believe the weakeſt of theſe proofs has had the greateſt effect in the eſtabliſhment of the received opinion, namely, that the nature of the blood returning from the inteſtines muſt be eſpecially ſuited to the formation of bile. It ſhould be proved, previous to ſuch an aſſertion, that the vena portæ carries a different blood from veins in general, and particularly from that of the vena cava, after it has received the hepatic veins; now this has not been attempted: if indeed ſuch a difference could be eſtabliſhed, it would throw conſiderable light upon the œconomy of the liver, but at preſent it muſt be admitted that all the facts applicable to the blood of the one are applicable alſo to that of the other. This point has been inveſtigated by others*, and I too have tried the ſmall quantities I could obtain from dead bodies, without being able to make out the ſlighteſt ſhade of difference.

On the other hand, the analogies ſeem ſtill more ſtrong, which would lead us to ſuppoſe, that one caſe of ſecretion reſembles every other, and that it is performed by an artery in the liver, as it is known to be in the other glands of the body, and the cloſe ſemblance it bears, in ſome reſpects, to the avowed arterial ſecretion of the ear, would ſomewhat ſtrengthen the opinion. But ſtill farther than this there is a caſe on record, which ſeems more deciſive on this ſubject than any artificial ſtate which can be induced by experiment. I allude to the diſſection related in the Philoſophical Tranſactions †, by the learned and accurate Mr. Abernethy, where the vena portæ was entirely wanting, yet good and perfect bile was found in the gall bladder. In this inſtance then the artery did ſecrete bile, it ſecreted it too without any aſſiſtance from the vena portæ, and it has been explained by ſuppoſing, that in a deficiency of one part another can occaſionally take up its neceſſary functions; this is ſurely not going ſo far as the data will juſtify, or even reaſoning fairly, we might juſt as well ſuppoſe it poſſible if the liver was entirely wanting, for the pancreas, or any other viſcus, to ſecrete the bile.

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* Hunter on the Blood, p. 76.

† Vol. lxxxiii.—1793.

It may likewiſe be mentioned, that the peculiar diſtribution of blood by the vena portæ ſubſiſts at a very early period of the exiſtence of the fœtus, though it is chiefly ſupplied from another ſource, and that this cannot be intended for the ſecretion of bile, which takes place in ſo ſmall a proportion to its cauſe during the continuance of the fœtus in the uterus.

To my mind, therefore, it ſeems as

if the ſecretion of bile was the particular function of the hepatic artery.

To aſſign another cauſe for the remarkable diſtribution of the vena portæ through the liver, is a ſubject of difficulty and hazard. I am, however, ſtrongly led to avow, in part, the ſame idea that the antients entertained, and to conſider it as ſubſervient to the purpoſes of the circulation, as a ſort of reſervoir to the heart, which prevents the rapid return of blood to the right auricle, which would take place without it; and, under circumſtances of difficulty or obſtruction to its paſſage through the lungs, allowing, by its diſtenſion, of a conſiderable accumulation for their relief.

I have been chiefly led to this opinion by an attention to the circumſtances of ſome diſeaſes; my own experience, however, has been hitherto too limited to give it the ſtability it requires, but ſtill there are ſome circumſtances which are too ſtriking, and have occurred too often, to be the effect of chance alone.

Authors have eſtabliſhed a certain connection in their ſymptoms between many diſeaſes of the liver and of the lungs, ſome of which have ſo much in common as to render diſcrimination difficult; but it has generally been thought, in ſuch caſes, that the liver was the original ſeat of complaint. I know but of one paſſage where the contrary has been ſuſpected, and this is given by Dr. Andree*, who quotes the opinion of a Mr. Paſley, a practitioner in India, that in all confirmed diſeaſes of the lungs the liver is affected.

In examining phthiſical patients, or ſuch as have, from any cauſe, had the lungs rendered leſs pervious to the circulating blood, I have very frequently found the liver enlarged in its ſize and looſer in its texture, in ſome very conſiderably ſo, and appearing little more than a connected maſs of blood, readily giving way, and breaking down on the application of ſlight preſſure; and, in other caſes, injections puſhed into the vena portæ have ſeemed to diſtend the liver more readily and compleatly than where no diſeaſe of the lungs ſubſiſted. The more violent of theſe affections of the lungs are alſo attended very commonly with great fullneſs of the abdomen and tenſion, eſpecially about the region of the liver. I have a caſe in my recollection where the formation of matter to a vaſt extent had taken place in the right lung, and had entirely deſtroyed it, in which the affection of the abdomen was ſo ſtriking *

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* Conſiderations on Bilious Diſeaſes, &c. p. 21.

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* A caſe given by Hallé may be conſidered as affording a ſtrong analogy. In a vaſt ſchirrus of the right lobe of the lungs, preſſing upon the heart and its veſſels, and obſtructing the circulation, all the abdominal viſcera were diſtended with blood. He proceeds, Le Foi me parut beaucoup plus volumineux qu'a l'ordinaire & d'une couleur preſque noire mais ſitot que j'en eut ouvert la ſubſtance, il en ſortit des flots de ſang, & ainſi degorgé, il ſe rapprocha beaucoup de ſon volume naturel, & ne parut, en aucun endroit, avoir ſubi aucune alteration, avoir ſouffert aucun engorgement.

Memoires de Medecine, Vol. I. p. 117.

as to induce the medical attendants, who were high in fame and ability, to rub thereon large quantities of mercurial ointment. It is known too, that, in caſes of accumulation of liquid within the lungs, the liver deſcends conſiderably below the edge of the ribs; if this was ſo immenſe in quantity as to fill the whole right cavity, and diſtend the diaphragm permanently, the liver which is attached to it muſt neceſſarily be puſhed downwards, but it happens that all ſuch collections of fluid do affect, by their preſſure, and diminiſh the capacity of the lung, rather than counteract the whole force of the abdominal muſcles, which are employed in exſpiration for the elevation of the diaphragm, and conſequent diminution of the capacity of the thorax; but ſtill it is true that the liver does deſcend, and I think ſuch deſcent may generally

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It is remarkable that Hallé, in the caſe above mentioned, ſuſpected the liver to be the ſeat of the diſeaſe. J'imaginois que le foie deſcendu juſqu'à l'ombilic & fort dur a toucher étoit le ſiége principal du mal.

be accounted for by its increaſe of ſize. I have avoided mentioning this enlargement as conſequent upon diſeaſes of the heart, becauſe it is not ſo upon all or even moſt of them; I have twice ſeen it combined with dropſy of the pericardium, and once with great flaccidity and enlargement of the whole heart, but never with oſſification of the valves, or ſome other of its diſeaſes which would ſeem to affect the circulation. It is known, moreover, that when any obſtruction ſubſiſts to the paſſage of the blood through the lungs, the foramen ovale is often found open; this, therefore, ſeems to be one mode which nature employs to relieve the load upon the lungs and right ventricle, and it is probable that ſuch caſes would not be attended with that affection of the liver I have deſcribed; I know not whether the two appearances are ever combined, but in the two laſt of theſe enlarged livers, which I ſaw, the foramen ovale was not open. I have thought, too, that where diſeaſes of the lungs ſeem to have produced enlargement of the liver in the firſt inſtance, that after they have long continued, the parts ſeem to accommodate themſelves to the new circumſtances in which they are placed, and to recover, in ſome degree, their original proportions. If we alſo reflect upon the exiſtence of this ſame diſtribution in the fœtus, where it does evidently ſerve the purpoſes of the circulation, we ſhall, perhaps, be more induced to believe that its functions in the adult are ſtill the ſame and unaltered.

The liver under this point of view will riſe in its importance in the animal œconomy; it is not to be conſidered as a mere glandular maſs, ſuited to the ſecretion of a particular fluid, but as miniſtering to, and, in a certain degree, regulating the circulation of the blood. Perhaps theſe opinions do not, from their nature, admit of perfect demonſtrative proof; it will be enough if, in the preſent inſtance, they carry with them probability, and lead to the farther inveſtigation of thoſe phyſiologiſts whoſe reflections bring them to the ſame concluſion with Haller.—*Non poſſum non ſuſpicari, præter Bilis ſecretionem eſſe hepatis peculiarem utilitatem.*

BILE is a fluid of conſiderable ſpiſſitude and tenacity, of an intenſe and peculiar bitter taſte, and rather a nauſeous ſmell. Its color is various, either of a bright golden yellow, or dark brown, or deep green, or of ſome intermediate tinge. Its ſpecific gravity is uniformly greater than that of water; I have found it 1,01, and 1,05.

It can only be collected in any quantity from the gall bladder, and when accumulated there it is found to differ in ſome reſpects from the bile as ſecreted by the liver. I believe that this difference does not extend to its taſte or color. The latter appears deeper from the greater quantity and denſity of the liquid, but if this and hepatic bile be equally and lightly ſmeared upon paper their tint will be very nearly the ſame.

The cyſtic bile is of much greater ſpiſſitude than the hepatic, and this difference depends upon ſome change produced after its reception into the gall bladder. This is commonly attributed to the removal of its aqueous parts by the action of the abſorbents, but I think it probable that it depends upon other circumſtances.

The bile is a perfect ſolution in water of a particular compound matter, and no mechanical means can ſeparate them; if the abſorbents effect this, they muſt poſſeſs a diſcriminating and diſcretionary power of ſeparating the ſolvent from the ſolvend, with which they do not ſeem to be endowed, and without which all the alterations they are ſuppoſed to produce upon this and other fluids are explicable; beſides, where, as in jaundice, theſe veſſels are certainly known to act upon the bile, they do not make this diſtinction; its aqueous part alone is not then removed, it is not inſpiſſated, but it is abſorbed *in toto*.

The gall bladder has internally a ſtructure which, from analogy, appears peculiarly ſuited to ſecretion; and when long continued obſtruction of the cyſtic duct has prevented the paſſage of bile, or any other matter into it, it has been found filled with a colorleſs and gelatinous fluid, which muſt have been ſupplied by itſelf. This fluid coagulates on the addition of alkohol, and reſembles that which the ſame ſubſtance forms when added to healthy bile; it is, therefore, probable that the gall bladder performs this office conſtantly, and that the preſence of this matter in bile depends upon a ſecretion made from its internal coat. Upon this addition, too, does the increaſed ſpiſſitude of cyſtic bile ſeem to depend; it is ſufficient for the production of the effect, but to aſcertain the fact it was neceſſary to examine the comparative relations to alkohol of cyſtic and hepatic bile, and to notice whether the preſence of this matter was demonſtrable in the latter as well as the former. Hepatic Bile cannot be well obtained in a pure and unmixed ſtate, and, therefore, it is difficult to aſcertain this point accurately; to me it appeared that a certain degree of the ſame effect was produced in each, but that in the cyſtic it was infinitely the greateſt.

Bile is wholly ſoluble in water into a tranſparent liquor diminiſhing in color in proportion to the degree of its dilution.

Heat ſeparates the water it originally contained, and if collected it reſembles pure water, with a faint impregnation from ſome odorous matter.

As the water evaporates, the remaining parts thicken into a brown tough extractive reſidue; if the heat be greater than is neceſſary for this evaporation, and be longer continued, it dries more perfectly into a friable pitchy maſs, which then ſeems to be very conſiderably changed in its nature.

The tough extract, if expoſed to the air, ſoftens and attracts moiſture from it, readily diſſolves in water, and appears to have undergone no change but what aroſe from its abſtraction.

Alkohol ſeparates from bile a great abundance of white membranous flocculi, diſſolving at the ſame time all the coloring particles, and aſſuming a tint of color proportionate to their quantity and ſhade.

The precipitate is ſeparable from the colored liquor by filtration; it generally retains ſome of the coloring particles ſo intimately united to it at the time of its aſſumption of a ſolid form, that it requires a very large proportion of alkohol to abſtract it entirely; this, however, may be done, and then it reſembles the coagulum produced in ſerum of the blood by the ſame addition.

Heat coagulates ſerous matter, even if it be mixed with four-fifths of water; ſometimes, but not commonly, it produces the ſame effect on bile, yet there is always a larger proportion of ſerum in the bile than is neceſſary for this purpoſe. It ſeems, therefore, that the preſence of ſomething prevents the effect of heat upon the ſerum, but admits of that of alkohol. Extract of bile, prepared from the tincture, was diſſolved in a mixture of one part ſerum and four water, and the mixture was heated ſufficiently for the coagulation of a ſimilar one, to which no bile had been added; in this caſe no coagulation followed; it was prevented by the preſence of the matter of bile, but this power was limited, for with a larger proportion of ſerum the uſual effect followed.

The relative proportion of this coagulable matter admits of conſiderable variation, and it is indicated by the ſpiſſitude of the bile, and by the effect of alkohol; ſometimes it is as thin as water, and alkohol produces but a ſlight change; at others it is almoſt as tenacious as bird lime, and the affection by alkohol is proportionally large.

The alkohol diſtilled from the tincture paſſes colorleſs, but has acquired a ſlight impregnation of a faintly odorous matter.

After this diſtillation there remansi a dark colored reſidue of an intenſely bitter, and joined with it a ſweet taſte ; it is perfectly ſoluble, both in water and in alkohol, in all proportions.

By this latter proceſs the part of bile, on which its peculiar characters depend, is ſeparated from its ſerous and gelatinous part.

If a ſolution of the ſpirituous extract of bile be dropped into very dilute muriatic acid no efferveſcence takes place, but an abundant cloudy precipitate immediately forms, which is deep in its color, according to the quantity of matter precipitated ; when this is very ſmall it is a dirty white, when more abundant a deep brown.

Other acids produce a ſimilar effect, but I ſpeak more particularly of the muriatic, becauſe it cannot be ſuppoſed to influence the reſult by its own decompoſition.

The fact that bile is coagulable by acids and by alkohol is generally known, but the two effects have been commonly confounded together, and I know not that any one has ſhown how the agency of the one goes beyond that of the other, or examined the matter precipitable by acids, after that coagulable by alkohol has been ſeparated.

The clear filtered liquor yielded, on evaporation, cubic cryſtals of muriat of ſoda; when acetic acid was employed acetate of ſoda was formed.

Thus it is proved that ſoda is preſent in the bile, and that it is not combined with carbonic acid, which would have produced efferveſcence, but with another matter which acids diſlodge by their ſuperior affinity.

It has been improperly adduced, in proof of the exiſtence of an alkali in bile, that it aſſumes a green tinge when mixed with vegetable blue infuſions; this change is probably deceptive, and at beſt very uncertain, for it may be occaſioned as well by the bare mixture of the two colors, the yellow and the blue, as by the agency of an alkali.

From the employment of bile in the arts for the removal of greaſy matters from cloth, and eſpecially in preparing it, by ſuch abſtraction, for the reception of various coloring ſubſtances, it has been conſidered as a natural ſoap *, and inferred that it muſt be like ſoap compoſed of alkali and oil. From this fact, too, it has been ſuppoſed that its uſe in the animal body was explicable, and that it ſerved to unite together the oily and aqueous parts of the food. The accuracy of the analogy between bile and ſoap might be queſtioned upon the ground that the ſame effect is often produced by the uſe of ſubſtances which contain neither alkali nor oil, as in the proceſs of fulling by fullers earth, and the incorporation of oils and water, by trituration with mucilaginous matters. The opinion, however, has been more compleatly overthrown by experiment †. Human bile, under no

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* Haller Primæ Linnæ.—Boerhaave Elem. Chem.

† Maclurg on the Bile.—Küchelbrucher de Saponibus.

circumſtance whatever, if aſſiſted by trituration or heat, can incorporate the leaſt portion of oil with water, the oil ſpeedily ſeparating and riſing to the ſurface. It was thought, by Schroeder, that the preſence of ſaliva, or the analogous pancreatic juice, might influence the reſult, and he tried the experiment without any difference in the effect.

Painters uſe bile for mixing their colors, and thus rendering them fitter for working, and hence it has been deduced that it reſolves and attenuates reſinous and gummy ſubſtances, but it has been found not actually to poſſeſs any ſuch property, for neither* ammoniac nor myrrh, nor balſam of Peru were diſſolved by it in the leaſt, and though ſome apparent union was produced during a long trituration of it with reſin of jalap, there was an almoſt immediate ſeparation when it ceaſed.

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* Schroeder Experimenta ed veriorem cyſticæ bilis indolem explorandam capta. Gotting. 1764.

The precipitate from the ſolution of ſpirituous extract by muriatic acid, either collected by ſubſidence or filtration, had a deep dirty brown color, and ſomewhat of a fibrous appearance, and its taſte was intenſely bitter.

It was not inflammable, but fuſed upon the application of heat, and left a ſmall cindery reſidue.

Water did not combine with it, it remained diſtinct, and ſank to the bottom.

Alkohol immediately diſſolved a great abundance of it, and aſſumed a bright brown color. The tincture, when dropped into water, formed an abundant precipitation. The evaporation of the tincture gave a reſiduary maſs of a deep brown color, and intenſely bitter taſte.

Eſſential oil of turpentine did not unite with it.

Alkali (it mattered little whether potaſh or ſoda) immediately diſſolved it, and formed a brown liquor, which appeared very accurately to reſemble the ſolution of bile, deprived only of its ſerous part.

If a clear aqueous ſolution of the ſpirituous extract and lime water was mixed together, a turbidity immediately followed, and a brown flaky ſort of matter collected at the bottom of the veſſel.

Diluted muriatic acid abſtracted the lime, and the inſoluble peculiar principle of the bile remained ſeparate.

It appears, therefore, that the attraction of lime for this matter is ſtronger than that of the alkali, which ſubſiſts in the original compound.

The natural compound of this bilious matter and alkali, being mixed with ſolutions of metallic ſalts, as thoſe of ſilver, mercury, copper, or lead, interchanged principles by a double attractive force, and yielded precipitates. Acetate of lead, for example, gave a very copious one, which had a dirty brown tinge in the ſolution, ſoon ſubſided to the bottom, and dried into a deep brown maſs, which, on being heated to redneſs, ſwelled, liquefied, and at laſt left a cinder, in which ſmall globules of the metal were viſible.

The ſoda then of the bile is combined with another ſubſtance, the compound is ſoluble in water, and gives to this ſecretion its peculiar characters. This other ſubſtance has been conſidered as a reſin, to which claſs of ſubſtances it has not ſufficient affinity to juſtify the arrangement. It liquefies in a lower temperature, it can ſcarcely be called inflammable, it is inſoluble in oil of turpentine, and unites abundantly and readily with alkalies. It ſeems rather to be a peculiar modification of animal matter, characterized by its bitter taſte, and other appropriate relations, and to bear a ſtrong analogy to a bitter matter, which exiſts, diſtinct from every other, in ſome vegetables, as the wood of the quaſſia amara. It may, perhaps, be denominated the animal bitter principle.

In inveſtigating the phyſiology of glands, it has been conſidered as an object of great importance to convert, by artificial means, the blood, from which all the ſecretions are formed, into a matter ſimilar to that which the action of any particular gland produces. If, however, this change was actually effected, our knowledge of the agency of a ſecreting gland, which does not employ ſimilar, or even analogous materials, would not be much increaſed, and this objection holds eſpecially againſt thoſe experiments which have been thought to explain the relation of bile to blood, by uſing nitric acid for the converſion of the latter into a yellow and bitter matter.

The relations of ſubſtances to each other are however always important, and I ſhall curſorily ſtate what others have done, and the concluſions to which a repetition of theſe experiments has led me.

Fourcroy ſtates that he mixed the freſh arterial blood of an ox with one third its weight of water, and expoſed the mixture to a heat ſufficient for its coagulation; that the liquor expreſſed from the coagulum yielded, on evaporation, a liquor ſtrikingly reſembling the bile of the animal, in color, ſmell, taſte, and chemical analyſis *.

Every repetition of this experiment proves that there muſt have been ſome fallacy in it, and it has been ſuggeſted, as probable, that the blood of the animal had previouſly contained bile, which only became more apparent from concentration, and was not actually formed.

Mr. Higgins mixed two parts of freſh blood with one of colored *nitrous* acid, and one fifth of the whole of water; he digeſted the mixture in a heat of 212, till the acid was wholly expelled, adding occaſionally more water to make up for what was loſt by evaporation, till at laſt the remaining liquor had acquired nearly the color, and exactly the taſte of bile. The *colored nitrous* acid he employed was diſtilled over in the form of *colorleſs nitric* acid*.

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* Extrait d'une Memoire contenant une ſuite d'Experiences nouvelles faites ſur les matieres animales au Laboratoire du Lycee a Paris par M. Fourcroy.—La Medicine eclairée, &c. Tom. II. p. 325.

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Mr. Archer, in repeating this experiment, obtained a liquor which reſembled bile in its color only, for it had no bitterneſs of taſte, and the whole of the acid was not detached till the evaporation had been continued, with repeated additions of water, for twelve hours †.

Dr. Boſtock alſo diſſolved each of the different conſtituent parts of blood in nitric acid, aſſiſted by heat; he inferred, on comparing his reſults, that the red particles alone were ſuited to undergo a converſion into bile, and he ſuppoſed that this effect was produced by their oxydation at the expence of the acid. He neutralized the undecompoſed part of the acid by a ſolution of carbonate of potaſh, and obtained nitre, mixed with a bright brown coloring matter; alkohol diſſolved this, and left, on evaporation, a matter perfectly reſembling bile [*].

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* Comparative View of the phlogiſtic and antiphlogiſtic Theories, by W. Higgins, 1789.

† Miſcellaneous Experiments on the Effects of Oxygen on the animal and vegetable Syſtems, by C. Archer. 1798.

M. Welter, by the repeated diſtillation of nitric acid from ſilk, with another view, obtained octohedral cryſtals, of a yellow color, and remarkably bitter taſte, which tinged the ſaliva yellow, were volatile in the fire, and were not decompoſed even by nitric acid, but only robbed of their color, which returned again on the addition of water [†].

There is conſiderable difference in the reſult of theſe experiments, as deſcribed by their authors. With me Mr. Higgins's proceſs has not ſucceeded; the acid was not ſeparated by a very long continued evaporation; and in proportion as it paſſed over, did the liquor loſe its characteriſtic color. Dr. Boſtock's ſucceeded better; it gave a deep yellowiſh brown maſs, bitter in its taſte, but, I think, more like the bitter of aloes than of bile, which ſtained the fingers and cloth, which diſſolved in alkohol, ether and water, and the latter ſolution frothed on agitation, which precipitated with acids and metallic ſolutions, and of which the moſt definite chemical difference from bile, ſeemed to be that its yellow color was brightened, and it was diſſolved in lime water, with which bile itſelf produced a copious precipitation. I did not, however, find any difference in this reſpect between the ſeveral parts of the blood; all yielded to me a ſimiliar matter, even perfectly limpid ſerum did ſo; and M. Welter's experiments alſo prove, that the preſence of red particles is by no means neceſſary.

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[*] Theſis quædam de ſecretione in genere & præcipue de formatione Fellis complectens.—Autore Joanne Boſtock. Edin. 1798.

[†] Annales de Chymie, Vol. xxix. p. 301.

Upon the whole, theſe experiments are not at preſent either ſufficiently various or eſtabliſhed to juſtify concluſions reſpecting the relation of bile to blood, though they are of importance in themſelves, and deſerve to be the ſubject of patient and accurate inveſtigation.

THE DISEASES which depend upon the ſtate of the liver may be divided into ſuch as affect the ſtructure of the ſubſtance of the viſcus, or its appendages; and ſuch as conſiſt in a morbid alteration of the fluid it ſecretes, either in quantity or quality, or in a derangement of its natural courſe. Like all other artificial diviſions of the operations and productions of nature, this is certainly imperfect; but it affords a convenient arrangement for my preſent purpoſe. The conſideration of each of theſe diviſions would lead me into a field of vaſt extent, affording, at every ſtep, objects deſerving moſt minute inveſtigation. I ſhall, therefore, confine the preſent inquiry to the two laſt alone, that is, to thoſe diſeaſes which ariſe from the ſtate or altered courſe of the bile.

Firſt, I ſhall ſpeak of thoſe caſes in which the *natural courſe of the Bile is deranged.*

When any obſtruction is made to the paſſage of the ſecreted bile out of the body, it is carried into the maſs of circulating blood, to which it gives, by ſolution in the ſerum, its own yellow color. The blood thus tinged, carries the dye with it to every part of the body, and the general hue is produced which conſtitutes jaundice.

It is ſcarcely neceſſary, under the preſent impreſſion of the agency of the abſorbents, to ſtate, that they are the medium by which the bile, under theſe circumſtances, enters the blood veſſels. But I have taken advantage of the examination of one jaundiced patient, to notice the ſtate of the thoracic duct, and ſaw evident and ſatisfactory marks of the preſence of bile in it. Dr. Saunders*, of whoſe accurate and ſcientific work upon this ſubject it is impoſſible to ſpeak too highly, obſerved the ſame yellowneſs in the abſorbents and thoracic duct of a dog, in whom jaundice had been previouſly produced, by a ligature upon the common duct. He likewiſe examined the relative ſtate of the blood contained in the hepatic veins, and in the other veins of the body, after the obſtruction had exiſted a ſhort time, and found that the ſerum of the former was evidently more loaded with coloring particles of bile than that of the latter. From hence it may be inferred, that in a liver diſtended by bile, the diſtenſion is not only relieved by the powers of abſorption, but by an impulſion of the diſtending fluid into the mouths of the hepatic veins, and that the bile reaches the blood by each of theſe channels.

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* Treatiſe on the Liver, p. 91.

When it has reached the circulation, the intenſity of tinge which different parts receive, will be in proportion to their vaſcularity, and the quantity of coloring matter thus carried to them. All the ſolid parts of the body, except the medullary ſubſtance of the brain, even the bones themſelves*, and the fat†, have been noticed as receiving an occaſional tinge; but the point in which the circulating bile is firſt and moſt clearly perceptible, is the ſclerotic coat of the eye, whoſe white natural color differs more from that of the bile than any other part of the body. Indeed this is frequently the only point on which our determination of the nature of the diſeaſe turns; for there are other complaints, as ſome caſes of chloroſis, in which the whole body aſſumes a yellow color, ſuch as might lead us to ſuſpect the preſence of bile, rather than that it was derived from any other cauſe; but in all ſuch caſes, the original whiteneſs of the eye remains, and aſſures us, that the circulating fluid holds no bile in ſolution.

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* Van Swieten, Sect. 950. Stoll Ratio Medendi, p. 3, Sect. 5.

† Morgagni, Epiſt. 37.

It may be well alſo to mention here that diſcoloration of the eye, which accompanies ſome diſeaſes of the liver, and leads us to infer their exiſtence, though it can ſcarcely be ſaid to amount to jaundice. Dr. Darwin* has aptly and ingeniouſly termed it *bombycinous*, comparing it to the yellowiſh blue and ſemitranſparent appearance of a full grown ſilk worm. The eye itſelf ſeems to be altered from its natural look, and to have ſuperadded thereto the ſlight yellowneſs of a ſmall portion of circulating bile, which, though univerſally preſent, is too ſmall to be diſcoverable in any other part. As the diſeaſe, occaſioning this ſymptom, increaſes in intenſity, it very frequently grows into a permanent and fatal jaundice, ſometimes requiring a conſiderable time, and as it were creeping on, and at others advancing with great rapidity.

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* Zoonomia, Vol. I. p. 354.

The ſecreted fluids, in caſes of jaundice, are very generally tinged deeply; indeed the milk is the only exception which is made by authors, and the affection is ſuppoſed to extend even to the ſemen *. In caſes of ſome duration the perſpirable matter is colored, ſo alſo is the ſaliva, which has a very bitter and bilious taſte; but the urine is much more highly impregnated with bile, and more ſpeedily than any other

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* Van Swieten Comment. T. III. p. 141. Heberden, Med. Tranſ. Vol. II.

of the ſecretions; its color, and the effect of a dye which it has upon immerſed linen, being among the common teſts to which obſervation recurs in the more early ſtages of the complaint. Poetic licence ſeems to have got the ſtart of common obſervation, in affirming, that this effect is extended to the aqueous humor of the eye [*], for, as far as modern enquiry has gone, neither of the humors nor the cornea have appeared to be colored, ſo that objects have not been ſeen through a yellow medium, or received a conſequent tinge from it. I have always myſelf aſked for this ſymptom, and have never found it [†]; not but what it is a caſe of poſſibility, and more particularly ſo where the diſeaſe has been of very long continuance and great intenſity, and we muſt not lightly reject the teſtimonies of Galen, Hoffman, Boerhaave *, and Sydenham †, who aſſert that they have occaſionally ſeen it.

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[*] Lurida præterea ſpectant quæcunque tuentur
Arquati. *Lucretius*, Lib. IV. v. 333.

——— to the jaundic'd eye
All things ſeem yellow.
Shakeſpeare.

[†] Dr. Heberden ſays, that all the jaundiced patients whom he ever aſked denied the truth of this pretended fact, for which (he adds) it is not likely that there was any juſt foundation. Med. Tranſ. Vol. II. p. 132.

The fluids which are often preternaturally collected in the cavities of the body, are alſo found tinged with bile, as more particularly thoſe ſerous effuſions which conſtitute dropſy, a diſeaſe connected very frequently with jaundice; and thoſe collected in bladders upon the ſurface in conſequence of the application of bliſters, or other acrid matters, to the ſkin ‡. So even is that fluid, which, under ſome circumſtances, is accumulated in the ventricles of the brain; and this is rather a curious circumſtance, as this differs in its nature from the effuſions into other cavities, even when both have evidently conſtituted a part

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* Nos tamen bina exempla in ætate virili conſtitutis obſervaſſe teſtamur.—Hoffman Med. Rat. T. IV. Par. IV. p. 302.

† Flavo quidem colore objecta omnia apparent afflictis tincta.—Proceſſ. Integ. de Ictero.

‡ Memoires de Medecine, Vol. VIII. p. 127.

of the ſame diſeaſe. In illuſtration of this I can mention a caſe of general dropſy, ſucceeded by apoplectic ſymptoms, which deſtroyed the patient; and the only evident cauſe of this preſſure had been the accumulation of a conſiderable quantity of water in the ventricles of the brain. Though the general effuſion conſiſted of the common ſerous fluid, coagulable by heat, alkohol, and acids, the contents of the ventricles were not ſimilarly affected thereby; this difference, perhaps, aroſe from the comparative ſmallneſs of the veſſels by which the ſecretion was made, and it only conſiſted in the want of this coagulable matter, for the ſalts, which are held diſſolved in the ſerum, impregnated both one and the other of the fluids. As, therefore, the bile paſſes through veſſels which retain the coagulable matter of ſerum, and allow the tranſmiſſion only of the aqueous part, and the matters diſſolved therein, I mean to infer, that the ſtate of exiſtence of the bile in the watery contents of the blood veſſels is not a mere diffuſion, but, like that of the ſaline matters, a perfect and compleat ſolution.

Such obſtruction, ariſing as it may from a variety of cauſes, is abſolutely neceſſary for the production of jaundice. It never accompanies thoſe caſes of immenſe ſecretion of bile which are called cholera, at leaſt I have never ſeen it in very violent ones, nor do I know any author who mentions it even as an accidental ſymptom; and if it had happened, it could not poſſibly have been overlooked *. I doubt, as far as I have myſelf obſerved, whether the yellowneſs which Sydenham has deſcribed as attending ſome continued fevers, under the name of jaundice, accompanied by abundant dejections of bilious fæces, did not rather depend upon a high degree of that diſcoloration of the ſkin,

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* Bianchi gives a caſe where this circumſtance was more narrowly inveſtigated, for he examined the lacteals of a man who had died from cholera, and found that their contents were not in the leaſt tinged by bile. Hiſt. Hep. p. 98.

which, in various intenſities, accompanies fever.

The abundant opportunities which European practitioners have had, within theſe few years, of obſerving the ſymptoms of that dreadful diſeaſe of the Weſt Indies, the yellow fever, have eſtabliſhed it as a fact, that the ſtrong diſcoloration which there takes place does not depend upon bile *. It does not appear in the ſame parts of the body, or obſerve the ſame gradations in its progreſs, that jaundice does, for the firſt yellowneſs is perceived along the neck in the courſe of the jugulars, and running along the cheeks in an angle from the noſe, irregular tinges paſs along the breaſt and back, and the feet are often deeply colored before the reſt of the body is materially affected. Beſides, from the time of Hippocrates †, an attack of jaundice,

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* Maclean on the Diſeaſes of St. Domingo, p. 34.

† Οκοσοισιν εν τοισι πυρετοισι τη εϐδομη η τη εννατη, η τη ενδεκατη, η τεσσαρεσκαι δεκατη ικτεροι επιγινονται αγαθον, ην μη το δεξιον υποχονδριον σκληρον η, ην δε μη, ȣκ αγαθον. Aphor. 64. Sect. 4.

towards the end of fevers, has been conſidered as a favorable prognoſtic, with one very wiſe exception of thoſe caſes where there is organic diſeaſe of the liver; but in the yellow fever this ſymptom does not appear to have been connected with any ſtriking affection of the liver, and yet the indication was fatal.

There is alſo another deceptive diſcoloration of the ſkin, which has been often conſidered as jaundice, which it is right to mention. It rather appears to be analogous, when it does occur, to that of fever*. Galen firſt ſupported the

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* It is remarkable that Galen (De Locis, Lib. v. Cap. 8.) does not conſider this as proceeding from the paſſage of bile from the liver to the ſkin, but from a change in the blood circulating there. Οϱαται δε και χωϱις κϱισεως εκχολημενον ενιοτε το αιμα κατα τινα διαφθοϱαν αλλοκοτον, οποια και θηϱιων δακνοντων γιγνεται. The antients were led, by the yellow color of the ſerum of the blood, to ſuppoſe that the bile exiſted ready formed therein, as one of its principles, and that the office of the liver was to concentrate theſe diluted coloring particles, which, on their ſeparation from the phlegm, or aqueous parts, acquired the more intenſe color of bile.—Galen Comment. in Epid. 3.

It is odd that Van Swieten ſhould exemplify the jaundice, occaſioned by the bite of poiſonous animals, by one opinion that jaundice was occaſioned by the bite of poiſonous animals, and there can be no doubt of the fact that ſome diſcoloration does enſue, for it is mentioned by other writers, and above all, by Fontana, but it is not a conſtant or even common phænomenon; I have watched for it in the adnata of animals, bit by a viper, without obſerving it, and neither Mead nor Lanzoni, nor Fontana, give thoſe minutiæ reſpecting the yellowneſs, which can enable us to form a correct judgement. Fontana ſuppoſes as its cauſe a ſtoppage of the biliary duct, from convulſive contraction of the duodenum*; and ſays, that the ſame ſymptoms follow other poiſons alſo; if it be ſo, arſenic which is immediately applied to the ſtomach, and which produces violent convulſion of that viſcus and the inteſtines, would a priori be conſidered as

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which followed the bite of a cat from Lanzoni, and another that of a dog from his own experience. Comment. Sect. 916.

* Fontana on Poiſons, Vol. I. p. 82.

moſt likely to produce it; now I myſelf have a recollection of three ſuch caſes without any icteric ſymptom, and neither Morgagni, nor Lieutaud, nor Wepfer, who enumerate the ſymptoms of this poiſon, notice it*.

Of the *Cauſes* which obſtruct the paſſage of the bile out of the body, the preſence of a concreted and ſolid ſubſtance of any ſort in the duct, is the moſt evident and ſtriking, and it is likewiſe very common. Biliary concretions are often formed in the bladder, and ſometimes paſs from thence through the duct into the inteſtines. The nature of theſe, and their relation to healthy bile, are to be conſidered hereafter, they are now only to be mentioned as a mechanically obſtructing cauſe.

Suppoſing then a concretion of this ſort to enter the cyſtic duct, its effect upon it will be in proportion to its ſize, ſo too will the length of time it will take in paſſing onward, but, generally ſpeaking, there will be no jaundice till it has quitted the cyſtic and entered the common duct; or rather, perhaps, till it has reached the extremity of the cyſtic duct, which, by its diſtenſion, muſt affect the paſſage through its neighbour; for in the firſt period of its progreſs it does not intercept the paſſage from the ſecretory organ into the inteſtines, and therefore does not prevent the departure of the bile from the body: that it cuts off the communication between the liver and its reſervoir is not ſufficient for this effect, at leaſt in any ſtriking or permanent degree, for after an obſtruction has exiſted in the paſſage of the cyſtic duct, the bile, which was contained within the bladder, is found to have been abſorbed, and it is then diſtended by its own peculiar ſecretion. If I am right in ſuppoſing the expulſion of the concretion to be principally made by the contraction of the bladder, then its entrance into the cyſtic duct implies an evacuation of its contents; it is therefore probable that the quantity of bile remaining in it is very ſmall indeed, that is, too ſmall to produce, by its abſorption, any noticeable diſcoloration; but as the bile ſo ſituated is found, when the obſtruction has exiſted long, to have been entirely removed, it will have produced ſome effect proportioned to its quantity, though M. Portal gives an account of an experiment in which he made a ligature upon the cyſtic duct of an animal, and no jaundice followed *.

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* Morgagni, Lib. ix. 3. 6.—Lieutaud Anat. Med. Vol. I. p. 39. Obſ. 134.—Wepfer de Cicut. aquat. c. xxi. 3.

When the gradual diſtention of the duct has allowed the entrance of the concretion into the common channel, the paſſage of the bile is ſo blocked up as neceſſarily to produce jaundice; but it has been ſuppoſed even in this caſe, and during the decided preſence of the obſtructing cauſe, that the obſtruction itſelf is not permanent, the duct, like muſcular canals, ceaſing to contract after the ſtimulus has been long ap-

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* Memoires de l'Academie, 1777.

plied, and allowing the paſſage of the bile round the ſides of the concretion; now this ſeems ſcarcely to be poſſible, for when ſuch relaxation of action does take place, which it is probable it does in ſome degree, the obſtruction to the paſſage of the concretion is removed as well as to that of the bile; it therefore, and more eſpecially if the duct be turgid behind, muſt be impelled forward, and be thus applied to a new ſurface, capable of being excited into action by its preſence.

Spaſm of the duct is another cauſe of obſtruction, the agency of which, to my mind, ſeems well eſtabliſhed, though it has often been denied; but even if we do not admit the exiſtence of a ſufficient contractile power in the duct itſelf to produce this effect, it may be accounted for from the affection of the muſcular coat of the duodenum, through which it paſſes. In ſome way or other, however, jaundice is the frequent attendant of diſeaſes which are called ſpaſmodic; thus it ſometimes comes on during the paroxyſms of hyſteria, and is ſudden in its attack, and of ſhort duration; it alſo follows violent fits of rage, and other mental affections *. It has been ſuppoſed that, during the general commotion of ſuch circumſtances, a concretion may have been puſhed from the bladder into the duct, and that the diſeaſe may have produced the jaundice in this way only †; but it often happens that there is no reaſon to ſuppoſe the exiſtence of ſuch concretions, and that none are found in the fæces after the ſymptoms have ſubſided, nor on examination after death, where it has proved fatal; the whole attack alſo has been too tranſitory, and too free from the general ſigns of the paſſage

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* Familiares ex mentis pathematibus icteritiæ ſunt. Bianchi, p. 220.

† Morgagni gives two diſſections where jaundice had followed an affection of the mind, in which no concretions were found on examination. Ep. 37. Art. 2—4.

Cullen appears to ſpeak much too ſtrongly, when he ſays, in ninety-nine of one hundred inſtances of this diſeaſe the paſſage of the bile is interrupted by biliary concretions, formed in the gall bladder, and falling down into the ductus communis. Mat. Med. Vol. I. p. 150.

of a concretion, to allow a ſuppoſition that ſuch was its cauſe.

Plethora of the veſſels of the liver is another probable cauſe of jaundice, for it may eaſily be imagined that a larger than the natural quantity of blood circulating through this viſcus, may preſs upon and block up the biliary ducts, and thus occaſion the abſorption of that bile to whoſe ſecretion it miniſters. In hepatitis this circumſtance occurs, for more blood paſſes through the veſſels of a part when inflamed than does in a healthy ſtate; and, according to Boerhaave*, this diſeaſe is occaſionally attended by jaundice; other authors mention this as a rare occurrence, and when it does happen, have rather explained it by ſuppoſing the inflamed part to be ſo ſituated as to preſs, by its increaſe of ſize, upon ſome of the larger branches of the biliary ducts; the inflammation of the liver is never, I believe, general, and we therefore cannot expect to meet with inſtances of general diſtenſion of the blood veſſels from a partial affection; but if my idea, that the bulk of the whole liver is frequently enlarged from the exiſtence of ſome obſtruction to the leſſer circulation, be juſt, we ſhall have abundance of caſes of general accumulation of blood in it, and if diſtenſion be a ſufficient cauſe, may expect to meet with ſome accompanied by jaundice. I examined the body of a woman who had died of phthiſis, and whoſe lungs were almoſt one maſs of ulcerated tubercle; within the laſt three days of her life, jaundice had come on to a very intenſe degree; there was no cauſe affecting the common duct, for the bladder was empty, nor was there any diſcoverable in the hepatic duct, as far as I could trace it; the lymphatic glands in the portæ were not præternaturally enlarged, nor could any external tumor be diſcovered. It therefore ſeemed that the cauſe was to be ſought within the ſubſtance of the liver; throughout it was much increaſed in ſize, it had a looſe texture, and doughy feel, and was, in every part, deeply tinged with bile; there ſeemed, therefore, to be a great accumulation of blood within the whole viſcus, which had at laſt proceeded ſo far as to obſtruct the biliary ducts, and thus produce the jaundice. Sauvages [*], one of our beſt ſyſtematic writers, ranks plethora among the cauſes of this diſeaſe, and gives an explanation of its agency, ſomewhat ſimilar to that I have now offered. Jaundice alſo occurs occaſionally towards the end of pregnancy, and this probably ariſes from a ſimilar ſource, and it is the more likely for this to be the caſe, becauſe evacuations, and particularly blood letting, remove it.

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* Aphoriſm, 918.—Fernelius, in his Pathology, ſays, that he ſcarce found one caſe in ten of Hepatitis accompanied by jaundice.

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[*] Sauvages Noſologia Methodica, Vol. II. p. 589. Aurigo plethorica.—Inter principia auriginis primarium eſt plethora ſeu major ſanguinis & humorum quam natura fert copia, cum enim circulatio ſanguinis per hepar ſit tardior quam in aliis partibus, quippe cum ſit in vena porta jam retardatus, cum a mole nimia ſanguinis cordi reſiſtentiam offerenti ulterius in hepate retardari, & ipſum ſanguinem inſpiſſari neceſſe eſt, unde ſupprimitur bilis ſecretio.

The intermittent fevers of this country, and the analogous remittents of warmer climes, are often accompanied by true jaundice, and when this happens towards their end, it is conſidered as affording a good, rather than a bad prognoſtic. There does not generally, in ſuch inſtances, appear to be any other diſeaſe of the liver than the increaſe of its ſize, with great accumulation of blood through its ſubſtance, and it is probable that the plethora, thus exiſting, may be ſufficient for the production of the jaundice which occurs.

Among the more rare caſes of obſtruction in the duct may be ranked a ſufficient thickening of its coats, to which Morgagni refers [*], and which Dr. Darwin imagines may be occaſioned in a ſufficient degree by a thickening of the membrane lining the ducts, analogous in its kind to that of the membrane of the noſe in catarrh, and which, like it, ſoon ceaſes, and the jaundice goes off [†].

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[*] Morgagni de Cauſis, &c. Ep. 37. Art. 10.

[†] Darwin's Zoonomia, Vol. II. p. 138.

The cavity of the duct may alſo be perfectly obliterated, as it is ſtated to be by Morgagni, but this is a very rare occurrence indeed. Dr. Baillie * never ſaw but one inſtance, and that was of the cyſtic duct; where it happens to the common duct jaundice muſt neceſſarily follow.

Greater denſity of the ſecreted matter of which I have ſpoken, among the morbid alterations, and which is readily abſorbed, does likewiſe occaſionally produce yellowneſs of ſkin, whiteneſs of the ſtools, and all the phænomena of jaundice, among the cauſes of which it ought therefore to be enumerated.

Enlargements of the neighbouring parts, as ſchirrus of the head of the pancreas, or ſcrofulous increaſe of the lymphatic glands in the capſule of Gliſſon, are common occurrences, and frequently are ſo ſituated as to obſtruct me-

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Dr. Saunders has frequently ſeen the ducts of dram drinkers ſo contracted and thickened, that they could not tranſmit bile. *Treatiſe on the Liver*, p. 184.

* Baillie Morbid Anatomy, p. 159.

chanically the paſſage of the bile into the inteſtines *; even ſimilar affections of ſome parts of the liver itſelf operate as extraneous cauſes, from their local ſituation, and ſtop the natural courſe of the bile; but ſchirrus is not uſually a general diſeaſe of the ſubſtance, it is confined to particular ſpots, of greater or leſs extent, and it not only obliterates the paſſage of the ducts, but deſtroys alſo the ſecreting veſſels of the part it occupies, and thus counteracts, in degree, the abſorption it would occaſion, by preventing the ſecretion of any bile to be abſorbed; it is only where, by its local ſituation, it obſtructs ſome of thoſe ducts which have already received bile from ſome healthy part, and are making their courſe towards the larger trunks, that it produces jaundice, and we often ſee that it has made conſiderable progreſs without any ſuch conſequence.

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* In a ſubject which Mr. Macartney examined for me, an hydatid, of large ſize and firmneſs to the feel, ſituated at the root of the meſentery, was the obſtructing cauſe of a permanent jaundice.

Literary men, and thoſe engaged in many ſedentary occupations, yield very generally to a curved poſture of the body. It ſhould ſeem that ſuch a poſture alone, independent of the more remote effects of ſuch modes of life, was ſufficient for the production of jaundice. That it is a diſeaſe peculiarly common under theſe circumſtances, is a well known fact, but how far poſture alone may be ſufficient, and if it be, in what way it produces this effect, may be the ſubject of ſpeculation. In the neceſſary attention to anatomical diſſection which is given by young men in their preparation for the profeſſion of phyſic, it is by no means uncommon to find attacks of jaundice, and that too at ſo early a period of their confinement, as can ſcarce admit of the ſuppoſition that it is acting as a remote cauſe; and, in ſome caſes of literary attention, the ſame fact holds good; now the only circumſtance in common in theſe two ſituations is the flexure of the body forwards; and it has been alſo the only circumſtance to which I have, in ſuch caſes, more than once felt myſelf juſtified in attributing the complaint.

Diſtention of the large inteſtines by air, which conſtitutes the diſeaſe called tympanites, has often jaundice for an attendant ſymptom, as I have once myſelf ſeen in a very high degree. Such a diſtention would, when it had ariſen to a certain point, impede the influx of bile into the duodenum, by its preſſure upon it, and upon the common duct, and I believe it only takes place when the diſtention is very conſiderable, and that on this account it may be conſidered as an unfavorable ſymptom. In the caſe to which I allude, the accumulation of air * was ſo great, that very ſpeedily after the appearance of jaundice the cæcum was burſt by it, and the patient of courſe deſtroyed.

It is farther a queſtion whether the production of jaundice is confined to

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[*] I examined the air in this and in another inſtance of the ſame diſeaſe, and found it to conſiſt of ſeven-eighths of the azotic gas, and about one-eighth of carbonic acid gas.

the obſtruction of the paſſage of the bile into the inteſtines; or whether any obſtruction to its paſſage out of the body after it has cleared its appropriate ducts, and reached the inteſtinal canal, may not likewiſe excite its abſorption into the ſyſtem and its neceſſary conſequences? Such obſtructions do often occur, as in caſes of volvulus, or hernia of the inteſtines, and in many inſtances of very obſtinate coſtiveneſs from other cauſes; but it does not appear that jaundice is by any means a common attendant on ſuch complaints, however probable it may ſeem that it ſhould be ſo. I believe, however, that this does ſometimes happen; that ſuch obſtruction not only may, but does, occaſionally, produce abſorption of bile from the inteſtines, and that the jaundice has been a ſymptom, rather than a cauſe, of ſome of the caſes of obſtinate coſtiveneſs on record, eſpecially of thoſe where the yellowneſs has vaniſhed after ſtools have been once obtained.

From an analogous infarction of the inteſtines of newly born children does their jaundice appear to ariſe, and not from any peculiar obſtruction in the ducts themſelves; there is a general torpor of the abdominal viſcera during the fœtal ſtate, the urinary and gall bladder are turgid with their contents, without contracting; the inteſtines are indolent, and do not expel the fluid ſecreted into them, till the motion of reſpiration brings the whole of theſe parts into action. The contraction of the gall as well as the urinary bladder, is aſſiſted by the preſſure thus produced; the whole of the contained bile ruſhes at once into the inteſtines, and if the quantity of mucus there accumulated retard its courſe, the abſorbents are rouſed to exert their office for the removal of the diſtention, and the bile is carried into the circulating blood. It is in proof of this opinion, that when children have motions ſoon after birth, ſuch diſcoloration never follows.

It ſometimes, however, happens that the bile is regularly ſecreted, but that it is retained in the body, and the ſtools paſs colorleſs without any diſcoloration of the ſkin; this is the caſe in that diſeaſe of the gall bladder in which its powers of contraction are wholly loſt, and which may be conſidered as a paralyſis of it, ſuch as ſometimes happens to the urinary bladder, between which and the gall bladder there are many ſtrong analogies. The accumulation in theſe inſtances has not unfrequently ariſen to ſuch an extent as to form a tumor externally, with an evident fluctuation, which has induced the ſurgeon to puncture it under an idea that the collection was matter *. Nor, indeed, if the ſtools are not colorleſs will the

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* Edinburgh Med. Eſſays, Vol. II. Art. 30.—Memoires de Chirurgerie, Vol. II.

Galen was aware of this diſeaſe, and reckons the diſtention of the gall bladder among the cauſes of jaundice—εγχωρει δε ποτε και πληρω θεισειν αυτην, ωσπερ η ουροδοχος κυστις ουρων, μη δυνασθαι κενωθηναι δι εμφραξιν η ατονιαν της εκκριτικης δυναμεως. *De Locis,* Lib. 5. ad finem.

Van Swieten Commentar. Sect. 950.

diſtinction between the two caſes be eaſily made; if however the tumor has been preceded by inflammatory ſymptoms, and that throbbing ſenſation which attends the formation of matter, its nature may be judged of with certainty, but the want of ſuch preceding ſymptoms is no criterion, for the appearance of abſceſs is ſometimes the firſt mark of diſeaſe in the liver. Tumors of this ſort are ſaid to have yielded to the preſſure made on examination, and to have vaniſhed by its continuance, with the diſcharge of an immenſe quantity of bile by the inteſtines; this goes to prove that no obſtruction, or a very ſlight one, exiſted; it proves likewiſe that the bladder, in its healthy ſtate, contracts for the expulſion of its contents, and that when its own powers are loſt, its relation to the neighbouring viſcera, and connection with the motion of reſpiration, which have ſubſiſted in their regular routine through the whole progreſs of the complaint, are not alone ſufficient for the purpoſe; it ſhows, moreover, that a diſeaſed ſtate of the abſorbents of the gall bladder can, under circumſtances otherwiſe favorable, prevent an attack of jaundice.

It happened to me to meet with two caſes within a ſhort time of each other, where a jaundice of ſome continuance was ſucceeded by decided apoplexy and death; the patients were both females and young, and did not appear likely to be affected with ſuch a diſeaſe as apoplexy. I regretted that circumſtances prevented an examination of theſe caſes after death, becauſe I could not help ſuſpecting more than an accidental occurrence between the two diſeaſes. The oldeſt writers on medicine have ſuppoſed a mutual ſympathy of this ſort between the liver and the head, which ſeems to be ſupported by a number of caſes on record, as well as thoſe I have mentioned. Baglivi gives a very ſimilar inſtance, and Morgagni more than one; his alſo were examined by diſſection, and it ſcarcely ſeemed that the morbid appearances of the brain were ſufficient to produce the ſymptoms. In one there was but a trifling gelatinous effuſion, and in another only a fullneſs of the veſſels, which he ſuſpected to be preternatural *.

The ſymptoms of jaundice are conſiderably modified by the cauſe which has produced it; but there are ſome of them which are conſtant, and which depend upon the preſence of this extraneous fluid in the circulation, and its abſence from the inteſtines. Omitting the obvious diſcoloration of the ſurface of the body, and loſs of the natural color of the ſtools, theſe are languor of pulſe, great depreſſion of ſtrength, and inaptitude to exertion, lowneſs of ſpirits, bitter taſte in the

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* Icteri nunquam ſpernendi nam ſub larva & perſona icteri, ſæpe magni periculoſi & repentini morbi abſconduntur, & ſæpiſſime moriuntur derepente icterici, ut ait Dodonæus. *Baglivi Praxeos*, Med. Lib. 1.

Baglivi gives a caſe of apoplexy ſucceeding to jaundice, p. 433.

Κακον δε και επι ικτερω καφώσις.

Praædict. Lib. I. Sect. 4.

Κακον δε και επι ικτερω μωρωσις.

Coac. Prænot. Sect. 2.

mouth, and great thirſt; a troubleſome ſenſe of general itching over the ſkin, attended by ſome elevation of points, which, in the recourſe which is had to ſcratching for relief, are more readily broken than the ſurrounding plain, and form coagulated ſcabs with a trifling ſurrounding inflammation.

It is generally ſtated, and as generally believed, that coſtiveneſs is a neceſſary conſequence of a want of bile in the inteſtines, and from this circumſtance it has been aſſerted, that the great uſe of the bile is to ſtimulate the inteſtines. If the poſition was founded in fact, the inference would be juſt, but, I think, this will admit of doubt. In truth, with the greater number of patients I have ſeen, the contrary has been the caſe, they have been rather purged than otherwiſe; and moſt of the clay colored ſtools of this diſeaſe, at which I have looked, have been remarkably ſoft in their conſiſtence. Nor is this obſervation ſingular or new; the learned Dr. Heberden's * experience led him to impugn the common opinion reſpecting this uſe of the bile upon the ſame ground. Sometimes, however, a very obſtinate coſtiveneſs does moſt certainly accompany jaundice †. I know not whether the diſtinction will hold, but I have fancied this to be more particularly the caſe in the jaundice of old people and dram drinkers, whilſt younger patients have moſt commonly been purged. But the very degree of this ſymptom, as it is deſcribed by authors, and as I myſelf have ſeen it, militates much againſt the want of bile in the inteſtines being its cauſe. Sup-

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* Med. Tranſactions.

† Phil. Tranſ. Vol. VII. p. 571. Van Swieten gives a caſe of obſtinate jaundice ſucceeding an intermittent, in which no medicine, not even tobacco ſmoke, produced any evacuation, and the patient died after eleven weeks.

Phil. Tranſ. N° 414. A man had a wound in the gall bladder, and conſequent effuſion of the bile it contained into the cavity of the abdomen, he ſuffered from incurable coſtiveneſs, and his inteſtines were ſo much diſtended with air, that before the body was opened tympany was ſuſpected. Dr. Whytt (Works, p. 50,) conſiders this inflation of the inteſtines as eſpecially taking place in thoſe who die of inveterate jaundice.

poſing, for a moment, that bile is the ſtimulus imagined, it acts with a definite force, exemplified in the daily occurrence of ſtools; now, under theſe circumſtances, any common purgative ſtimulates the inteſtines ſtill more, and produces more copious evacuations; but when bile is abſent, and there is coſtiveneſs, even the ſtrongeſt purgatives fail of their effect, though, as far as their ſtimulating power goes, they muſt infinitely ſurpaſs any quantity of the bile itſelf. If, too, this deficiency was the ſole occaſion of ſo unpleaſant a ſymptom, it might be thought that the bile of animals might be advantageouſly employed for its removal, but even this does not anſwer, nor has a ſcruple of inſpiſſated ox bile ſtimulated my own inteſtines to more frequent or copious diſcharges. Upon the whole, I think that coſtiveneſs ought not, in this caſe, to be attributed to abſence of bile, and that bile is certainly not the ſtimulus which has been imagined.

WE next come to thoſe diſeaſes which depend upon a *morbid alteration of the bile*; of theſe the firſt, and perhaps the moſt important, is that *tendency to form ſolid maſſes, which afterwards act mechanically in the production of great and ſerious inconveniences.*

In by far the greater number of examinations in which I have ſeen biliary concretions, their preſence had not been ſuſpected during the life of the patient, ſo little peculiar derangement had they produced. They have ſometimes, but very rarely, occaſioned ulceration * of the inner coat of the bladder, and given birth to the train of ſymptoms which muſt neceſſarily attend ſuch a caſe; but it may be ſtated generally that, during their continuance there, they are harmleſs †, and that much inconvenience only attends upon the accident of their being carried from thence into the narrower ducts, whoſe cavity muſt be diſtended for their paſſage, if they are of any ſize.

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* Dr. Soemerring has ſeen a good many inſtances of ulceration in the inner ſurface of the gall bladder, from the irritation of gall ſtones. *Baillie's Appendix to Morbid Anatomy*, p. 80.

† Si fuerint in veſica, ſigna ipſorum difficilia ſunt, obſcura, & vix humana mente inveſtigabilia. *Baglivi Opera*, p. 434.

From conſidering the circumſtances of theſe concretions in the bladder, it ſeems probable that no other cauſe can bring about their entrance into the duct but the contraction of the bladder itſelf, and that the poſition of the body, which has been ſuppoſed to operate in placing it in this ſituation, has nothing to do with it. Concretions of large ſize, large enough that is to obſtruct the ducts moſt completely, are generally lighter than water; if ſo, they would of courſe riſe to its ſurface, and if the gall bladder was filled with water only an upright poſition, in which the neck is higher than the fundus, would be more unfavorable than a contrary one; but the cyſtic bile, in which theſe concretions float, is a thick ropy fluid, particularly ſo too where they are preſent, and this would by no means admit of the operation of ſlight differences of ſpecific gravity. It is probable that the evacuation of the gall bladder is only partially made, and its ſurface is defended by a very thick mucus, ſo that a concretion may be ſuppoſed to exiſt for a great length of time, enveloped as it were in the fluid contents, without impreſſing upon the bladder ſuch inconvenience as to excite the neceſſity for its removal, and that it does ſo at any time may depend more upon accident than the operation of regular cauſes. There ſeems to be an eſtabliſhed principle in all the canals of the body, by which their contents are uniformly protruded one way, independent of gravitation or any other external cauſe, and this principle acts in the paſſage of the concretion, for it is carried along the duct towards the inteſtines, by an action which the ſtimulus of its preſence excites, and the exiſtence of almoſt a reaſoning power, which regulates the actions of thoſe parts of the body which are not under the influence of the mind, is more particularly viſible in this inſtance; for with reſpect to its own natural fluid the duct allows a paſſage through it both to and from the bladder, but with an extraneous body once impacted, it does not ſeem to admit of receſſion.

It has been imagined that the degree of angularity of theſe concretions muſt conſiderably influence the ſymptoms they produce, it being a form more particularly calculated to occaſion pain in parts to which it is applied; this ſcarcely however appears to be the caſe, for their angles are never ſharp enough to cut, or their points to perforate; but I am more particularly inclined to think that ſhape does not affect their ſymptoms, from remembering that the ſharpeſt pointed and moſt jagged urinary calculus I ever ſaw was not ſuſpected to exiſt, and produced not the leaſt uneaſineſs till the bladder was accidentally examined after death.

Size is a matter of more importance in general than ſhape, for in proportion to it will the diſtention of the duct, and the difficulty of the paſſage of the concretion be greater or leſs; but even this is of leſs conſequence than one might at firſt imagine; for very ſmall and round concretions, whoſe conſiſtence too has been ſoft, have occaſioned great violence of ſymptoms in ſome caſes, and in others large and angular ones have been paſſed with a much leſs degree of inconvenience.

In this, as in every other inſtance of diſeaſe, the ſtate of the ſubject acted upon very eſſentially modifies the effect of any given cauſe; we know not, however, the ſource of theſe peculiarities in individuals, or more than the certainty that ſuch do exiſt.

The violence of any ſingle attack may alſo be conſiderably influenced by preceding circumſtances. The duct, when it has been diſtended by the paſſage of a large concretion, does not ſoon return to its original dimenſions; authors mention it as being found, in ſome inſtances, of a much larger ſize than natural*. The protruſion, therefore, of one concretion would facilitate the paſſage of ſubſequent ones, and even if its ſize was the ſame, the ſecond would, under theſe circumſtances, produce leſs miſchief than the firſt.

The ſymptoms which ariſe will be beſt deſcribed by taking the moſt violent caſes, which are not commonly met with, and allowing in the oppoſite extreme for the paſſage of the concretion without the attendance of a ſingle ſymptom, and in intermediate ones for every poſſible variation in degree.

They may be divided into ſuch as depend upon the diſtention of the duct, upon the ſympathy of neighbouring or diſtant parts, and upon the obſtruction to the paſſage of the bile.

The attack often commences ſuddenly, with ſhiverings, which afterwards occaſionally recur; a violent and acute pain at the pit of the ſtomach, more ſo apparently than that which attends upon acute inflammation; this pain ſeems generally to be confined to that point of the epigaſtric region which very accurately correſponds to the ſituation of the opening of the common duct into the duodenum, and from hence it appears to dart through to the back; the pulſe is very little increaſed in quickneſs or in ſtrength, and has none of the hardneſs which attends upon inflammations; the breath becomes ſhort and hurried; there is great general anxiety and reſtleſſneſs, often amounting to delirium, and at laſt great depreſſion and fainting; the ſtomach is affected by nauſea, and there are frequent efforts to vomit. Theſe ſymptoms, however, laſt not long in all their fury, ſoon remitting and allowing ſhorter or longer intervals of eaſe, during which no acute pain is ſuffered, but there is a ſenſe of deep ſeated ſoreneſs and fullneſs of the epigaſtric and right hypochondriac region; the patient keeps the body bent as the poſition attended with moſt relaxation of the affected parts. Another fit, perhaps of equal or greater violence than the firſt, then comes on and alternates with another remiſſion, and after an uncertain number the more urgent ſymptoms ſuddenly ceaſe, the ſoreneſs and uneaſineſs gradually, but quickly, diminiſh, and the patient is reſtored to eaſe.

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* Baillie Morbid Anatomy, p. 159.—Van Swieten Commentar.—Vicq. d'Azyr Mem. Par. Vol. III. p. 220. —Heberden Med. Tranſ. Vol. II. p. 135.—Heiſter Acta Natur. Curioſ. Vol. I. p. 404.

At ſome early period of theſe attacks the jaundice makes its appearance, and continues for a conſiderable time after the violent ſymptoms have departed, producing its uſual inconveniences; it may ſoon, however, when the concretion has paſſed, be perceived to diminiſh in its intenſity, but before it will entirely diſappear it requires that the whole quantity of the tinged ſerum be removed by a gradual dilution, with a freſh ſupply in a natural ſtate.

Inquiry ſometimes ſhows that theſe attacks have been preceded for ſeveral days, or even weeks, by a ſenſe of fullneſs and uneaſineſs about the ſtomach and region of the liver, eſpecially after eating, but neither ſufficient in duration or degree to excite alarm, and the leſs ſo as it has yielded, for the time, to ſome domeſtic ſpirituous remedy.

It is impoſſible for thoſe who have witneſſed the progreſs of a natural labour not to be ſtruck with the reſemblance which many of its ſymptoms bear to thoſe of this diſeaſe; it is indeed the term of compariſon to which females have recourſe to expreſs their ſufferings. The attacks of each conſiſt in the ſame efforts to expel an extraneous body, and in the ſame violent diſtention of a paſſage, but they differ in circumſtances dependent upon the peculiar ſituation of the part affected.

The pain is clearly referred to one ſpot, and that moſt probably not the actual one, where the concretion is preſent, but in whatever part of the duct that may be, the ſenſation is at the termination of the canal in the duodenum. It rarely happens that our own feelings accurately indicate the part affected, and we are often obliged rather to truſt to the ſympathies of diſtant ſituations for our knowledge of diſeaſes. That of which we are now ſpeaking, which refers the pain ariſing from an affection of any part of the biliary duct to its terminating point, has a ſtrong analogy in many of the various diſeaſes of the urinary bladder, in which there is a ſtriking uneaſineſs of ſenſation at the extremity of the penis. In acute inflammations of the liver itſelf, as in ſome caſes where it has been wounded, and it is ſaid occaſionally too from the paſſage of concretions, the pain is felt chiefly at the tip of the ſhoulder, and ſometimes this has been the only ſpot of which the patient has complained*. In the ſeveral caſes of colic, in whatever part of the canal the diſeaſe may actually exiſt, it is referred to the region of the navel. That theſe ſympathies are eſtabliſhed as facts, by obſervation and experience, is all we know of them, nor does the connection of particular nerves, or any other theory which has been invented, give even the ſhadow of a ſatisfactory explanation.

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* Some of the old authors attribute this ſymptom to the increaſed weight of the liver drawing downwards the membranes which line the thorax. *N. Piſo de cognoſcendis & curandis morbis*, Lib. iii. cap. 25.

I once ſaw a caſe of wounded liver where this was the only ſource of inconvenience, without any reference to the part actually affected.

With reſpect to the nauſea and vomiting which occur, we may notice the remarkable ſympathy of the ſtomach with the affections of other, even diſtant parts, and more eſpecially with thoſe important organs which are ſituated in its neighbourhood. The liver is a very large maſs, and it does not appear that the ſtomach is affected by diſeaſes of its ſuperior and diſtant ſurface, but only by thoſe which lie contiguous: thus the ſchirrus, which follows the abuſe of alkohol, is generally attended by dyſpepſia, which is its worſt and moſt troubleſome ſymptom, and I have thought that this ſort of ſchirrus uſually begins in the parts of the liver contiguous to the ſtomach, and that it can be firſt and beſt aſcertained by examining that part which lies near it in the epigaſtric region.

The duration of the attack, conſidered as including the whole time of the paſſage of the concretion, is as various as its intenſity; ſometimes a few hours, ſometimes ſeveral days, or even weeks, elapſe before it is expelled; in the former of theſe caſes it is often ſo rapid as not to allow time for the jaundice from obſtruction of the duct, to take place, though the other ſymptoms are ſufficiently marked and acute. Now in the abſence of ſo deciſive a ſymptom, we ſhould be cautious in forming an opinion of the cauſe of the attack, and even where it does attend, ſhould direct a careful examination of the fæces, to diſcover the concretion which may have paſſed among them out of the body.

Concretions have occaſionally been paſſed, of the nature of which there cannot be a doubt; but which, from their ſize, never could have paſſed through the gall ducts. I have ſeen ſingle pieces of ſuch, which were more than an inch in their diameter, and three inches in length; theſe then muſt be ſuppoſed to have paſſed directly from the bladder to the colon, by a previous adheſion, and ſubſequent union of the two cavities, as happens in many caſes of abſceſſes of internal parts. As far as the abſorption of parts is concerned, preſſure is often ſufficient to excite it, without any general derangement, but ſuch a paſſage of concretions implies another action, that by which adheſion is formed, taking place, for it is neceſſary that the peritoneal coat of the bladder and that of the gut ſhould unite; this I believe cannot happen without inflammation, and if it cannot there muſt be ſufficient peculiarity of ſymptoms in ſuch a paſſage to characterize it; but I ſpeak doubtingly, for I have never ſeen a caſe where it was ſuſpected. Or there may be another opinion entertained, that the concretion, though evidently biliary, may have been formed or increaſed conſiderably in its ſize in the inteſtinal canal, and not in the gall bladder. Either caſe is poſſible, but the former is the moſt probable, for thoſe calculi, which are ſometimes found in the inteſtinal canal, have their nucleus encruſted with peculiar ſaline matter, and if even a biliary concretion remained long in ſuch a ſituation it would probably become the central point of a ſimilar depoſition, rather than of bile, or at beſt be mixed with it, and in the largeſt biliary concretion that I have examined there was no ſuch appearance.

Another effect of biliary concretions is that they are occaſionally connected with entire obliteration of the cavity of the bladder, and remain impacted in its neck without the production of any noticeable inconvenience. I ſtate this on the authority of a caſe Mr. Crowther and myſelf examined, the ſubject of which had died of complaints unconnected with the liver; a ſingle concretion of no large ſize had lodged in the neck of the gall bladder, whoſe cavity was ſo perfectly cloſed that conſiderable force could not drive the ſtone back into it, and we almoſt imagined, at firſt ſight, that the gall bladder was wanting. Its ſubſtance, on examination, however, appeared much thickened, and it ſeemed probable that there had, at ſome previous period, ſubſiſted an inflammatory action, which had terminated in theſe adheſions, of which perhaps the ſtone might have been the original cauſe.

Biliary concretions are ſometimes found lodged in cyſts, hollowed as it were out of the ſide of the bladder, and attended with conſiderable increaſe of thickneſs of its coats; but moſt commonly they are looſe within its cavity, and it is ſcarcely neceſſary to obſerve that theſe latter alone can be carried into the duct, or produce the ſymptoms which depend upon their paſſage.

Concretions of a ſimilar nature are ſaid to be found in the ſubſtance of the liver itſelf, and plates are given, by by ſome authors, repreſenting them as diſtending the branches of the biliary ducts *; but ſuch caſes are rare, I have never met with one, and Ruyſch, in all his immenſe reſearches, with only one †. Gliſſon ſpeaks of an incruſtation of the biliary pores in the livers of ſtalled oxen, following the ramifications of the duct, and thus, where they could be taken out in a tolerably perfect ſtate, reſembling the branching forms of coral. He mentions, too, a caſe of depoſitions of the ſize of peaſe, abounding in the liver of a ſtrumous patient; but of the nature of theſe, and whether they were biliary, or only tubercles,

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* Walter Obſerv. Anat. p. 46.—Coe on biliary Concretions,

† Vicq d'Azyr gives a figure of one found in the hepatic duct of a horſe. *Mem. Par.* Vol. III.—Obſerv. Anatom. xvii. p. 417.

Sunt hi lapides iis qui in veſicula fellia reperiuntur plano congeneres & figura ſolum diſcrepant. *Anat. Hepat.* cap. 7. ad finem.

there are not ſufficient data to form a judgement.

Sometimes the long continued impaction of the ſtone in the duct is productive of inflammation and ulceration therein, and has all the laſting inconveniences which ſuch affections produce; and it has happened that the duct has burſt during ſuch impaction, and neceſſarily excited a train of ſymptoms from its diſcharge into the cavity of the abdomen, which have ſoon proved fatal.

When, however, the concretion has once entered the duodenum it ceaſes to do further injury, and generally paſſes out of the body with the fæces, but as its paſſage is often accompanied by vomiting, and an inverſion of the natural motions of the ſtomach and duodenum, it is occaſionally brought thereby into the ſtomach, and diſcharged by the mouth*. In the latter of theſe caſes it cannot well be unnoticed by the patient, but it is ſeldom that the ſtools receive ſufficient inveſtigation for its diſcovery, unleſs the ſize has produced ſome ſenſible difficulty on its quitting the body.

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* Hoffman Med. Rat. T. IV. p. 273.—Coe quotes a caſe of this ſort from Dr. Huxham, p. 73.—Burſerii Inſtit. Med. Vol. IV. Sect. 162.

Theſe concretions which are found in the gall bladder have appearances ſo various as ſcarcely to admit of general arrangement.

Firſt, with reſpect to their *external form* it may be remarked, that this never takes the definite angles of one regularly formed cryſtal, and that even thoſe which come from the ſame bladder, and reſemble one another in their compoſition, vary ſo much, that out of ſome hundreds no two will be found bearing that ſort of ſimilitude to each other which ſubſiſts among the different cryſtals of the ſame ſalt. Where a number is contained, their general ſhape is ſuch as to apply them cloſely to each other, and accommodate the whole collection to the form of the bladder. Where they are few and large, this is ſometimes effected by truncating the end of each, or ſometimes by rounding the end of one, and hollowing out that of another in a ſmall degree, for its reception; ſo that by this cloſe application they form, as it were, but one concretion with reſpect to the bladder. At other times, however, they remain perfectly diſtinct, and without any marks of their having been in contact *. Where a ſingle one only has been found, and that ſmall in its relation to the cavity of the bladder, it has, for the moſt part, a rounded ſomewhat oblong form, and ſometimes a perfectly ſmooth and equal ſurface, but more commonly it is unequal, and bears, in a ſlight degree, the appearance of the mulberry, ſeeming as if it was compoſed of little agglutinated nodules; this appearance, however, is confined to the ſurface, and does not affect the interior part; ſometimes the nodules are larger, the whole ſtone

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* A concretion of this ſort, of the ſize of a hen's egg, is deſcribed and figured in Mem. Par. Vol. III. p. 219.

being compoſed of only two or three, which give to its ſurface a bold undulated form, and ſometimes they project into ſharper and more acute points.

It would be difficult to expreſs the different ſhades of color theſe concretions poſſeſs; they are ſometimes cryſtals*, colorleſs, ſhining, and ſemitranſparent, and vary from hence down to an opaque white; commonly they have ſome variety of brown tinge running through orange to a light yellow on the one part, or on the other through various intenſities of brown to a deep green, or perfect black. In ſome theſe colors are mixed in layers on the ſurface, and more eſpecially in thoſe large ones, which bear marks of cloſe application to a fellow, where the white and brown, and yellow, ſometimes run together in irregular marbled veins.

They differ alſo in their conſiſtence, ſome have a ſlight ſoapy feel, and may be ſcratched by the nail, others are friable, and break into duſt on the ſlighteſt degree of violence, and others are hard and difficultly broken.

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* It is moſt probable that thoſe which Van Swieten called *gypſeous*, ſolely from their external appearance, were of this ſort. *Comment.* Sect. 916.

In their internal ſtructure the appearances are more conſtant, and, under this point of conſideration, they may be divided into cryſtallized, depoſited, and amorphous; the two former of theſe being to be conſidered, in very many inſtances, as only different modes of exiſtence of one and the ſame matter.

Cryſtallized concretions are not unfrequently found of a lamellated ſtructure, the plates radiating from the centre to the circumference, they have ſomewhat of an unctuous feel, and look like ſpermaceti, and the cryſtals, like it, are eaſily broken into a greaſy ſort of powder, theſe are generally ſemi-tranſparent, and but ſeldom retain their purity throughout, being, near the cirference, mixed with more or leſs of a brown coloring matter. At the central point of theſe colorleſs cryſtals, to which the radii converge, there is moſtly a ſmall parrticle of colored matter, reſembling bile; ſometimes this cryſtalline ſhoot, having reached perhaps the ſize of a pea, becomes itſelf a centre, around which various depoſitions are afterwards made, in a more or leſs confuſed or regular way.

The radiated cryſtals are very often depoſited in ſeparate ſtrata around any nucleus; theſe are frequently numerous, laying one upon the other, and the tendency to a regular form is ſcarcely viſible in ſome; in moſt of this ſtratified ſtructure they have alſo rather a ſpicular than a lamellated form; the ſtrata are ſometimes uniform, and well defined by a deeper line of various ſhades of color, running between each, and reſembling ſome varieties of the ſtriated gypſum, which lies over ſalt mines.

Very commonly alſo the cryſtalline form is entirely loſt, and a confuſed depoſition of the ſame ſort of matter is made, ſtanding to it in the ſame relation that the common depoſitions of carbonate of lime do to its cryſtallizations. If theſe be melted by heat, and gradually cooled, they aſſume the more regular ſpicular cryſtalline form exactly. They are of various ſhades, from white to deep brown, and generally break through their centre on the application of moderate force, diſcovering a nucleus, for the moſt part of a deep brown color. In their external form they are uſually variouſly angular.

The mixture of theſe two modifications of cryſtallization and ſtratified depoſition allows of very great variety, and the moſt common of all concretions partake confuſedly of both. In the angular and wedge ſhaped ones, which frequently fill the whole bladder, there is often an internal cryſtallization, marked by a circular boundary, and then a depoſition of ſeveral ſtrata growing more and more into the angular form. Sometimes there is only a thin layer of depoſition, incloſing a maſs apparently of common bile, of various degrees of conſiſtence and ſolidity, beſet with very ſmall white ſpots, which, when viewed in a ſtrong light through a magnifying glaſs, have a beautiful appearance of little cryſtallized globules.

The amorphous concretions are ſuch as bear no marks of cryſtallization, or rather regularity of ſtructure, and which ſeem to contain none of that peculiar matter which characterizes the former; it is upon the abſence of this that I would particularly found the diſtinction. Sometimes, even as they dry, they have a tendency to break into layers, a circumſtance which ſhows the mode in which they were formed; but theſe layers are very thin and very friable, and have no appearance of cryſtallized matter in them. For the moſt part ſuch concretions have an irregular ſhining fracture, falling into pieces on the application of the ſlighteſt force. They are, in their color, commonly black, and may be conſidered as reſembling coal. When they break into layers I have noticed that their external color is very frequently a deep bottle green, or dark brown, and in ſome caſes they are reddiſh brown, like clays containing iron, after they have been burnt. Perhaps of theſe latter here are many more varieties than I am acquainted with, I think indeed that there are, but they are much leſs common than the former ſorts.

Next with reſpect to the nucleus of theſe concretions, which ſeem to be, in every inſtance, neceſſary for the cryſtallized or ſtratified varieties, though there is none apparently to the amorphous. Sometimes the depoſition of this cryſtallizable matter is made in a thin cruſt around a ſoft and porous piece of bile, which is often ſtudded here and there with points of cryſtallized matter of various ſizes; where the nucleus is of bilious matter it often bears a curious appearance, as if it had dried after its firſt formation, for it is found cracked and ſhrunk into various irregular fiſſures, but this ſeems rather to take place after it is taken from the bladder, and not to ſubſiſt when it is freſh, and in its original ſituation. In the centre of the cryſtallized globule there is often a bit of bile incloſed from which the radii have ſhot.

It is probable, from the appearances which have been deſcribed, that many of theſe ſtones, which have the radii paſſing without interruption from the centre to a conſiderable diſtance, are almoſt immediate in their formation, and ſhoot into that form as ſoon as a nucleus is offered to them, whilſt the ſubſequent ſtrata are the work of time, and of a ſeries of diſtinct cryſtallizations.

Chemiſts are well aware, in many operations, of the importance of a nucleus to begin that arrangement of particles which builds up a cryſtal, and its neceſſity is not leſs in ſimilar proceſſes within the human body, for without ſome point to act as a foundation neither the biliary or urinary concretions unite to form cryſtals. Camper has an experiment ſtrikingly illuſtrative of this fact, which he gives as follows [*]: "My

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[*] Kleinerer Schriften.

" chamber pot being much furred, by
" depoſition from my urine, I had it
" ſcoured quite clean, and beſmeared
" one half of the inſide and bottom
" with oil, the pot was daily waſhed
" with warm water, and beſmeared in
" the ſame place with the oil; the ſide
" where no oil was became much in-
" cruſted, but not a particle of depoſi-
" tion where it was ſmeared."

I have met alſo with bile, which was of its ordinary fluidity, without any appearance whatever of concretions, which evidently contained a quantity of the peculiar cryſtallizable matter of which ſuch concretions are formed. In ſuch a caſe, therefore, it is probable that nothing but a nucleus was wanting to its formation, and that if accident had ſupplied this, a concretion would have been found in the bladder. The only peculiarity of this bile was its remarkably deep and almoſt black color, of which I have ſpoken elſewhere, as connected with the exiſtence of concretions, and it was this circumſtance that led me to examine it more particularly. It may be aſked how the preſence of this matter could be aſcertained. Alkohol of a temperature under 50° was added to it, ſo as to coagulate the ſerous part, and diſſolve the ſeparated bile. In ſuch a temperature it will be found that it does not diſſolve any of the matter of concretions. On one portion of the ſeparated reſidue alkohol was boiled, which as it cooled, depoſited lamellated cryſtals, and on another ſulphuric ether, which, as it evaporated, produced the ſame appearance.

Biliary concretions vary conſiderably in their ſpecific gravity, and this variation does not appear to be connected with any peculiarity of ſtructure. Of two of my pureſt cryſtallized ſpecimens one ſank and the other ſwam in diſtilled water; the black and deep colored angular ones generally ſank, while others, eſpecially where they had a tendency to a cryſtalline appearance, uſually ſwam. No general ſtatement, therefore, can be given; probably it allows of a range not much differing on either hand from the ſpecific gravity of diſtilled water, for ſome which ſank in it, ſwam in our New River water, which contains but a ſmall proportion of ſaline matter, and therefore is very little more denſe; and others which ſwam in diſtilled water ſank in alkohol, or even in common rectified ſpirit.

Chemically ſpeaking, there appear to be two diſtinct ſpecies, differing from each other in their relation to other ſubſtances; both of theſe are ſometimes found, in a greater or leſs degree, contaminated by heterogeneous matters.

The cryſtallized and colorleſs concretions ſeem to contain one of theſe in a ſtate of the greateſt purity.

On bringing ſuch near to a burning body they liquefied, and then took fire, burning like common wax, but with a thick white ſmoke and unpleaſant animal ſmell.

Water did not diſſolve or affect them in the leaſt, even when its temperature was increaſed to boiling.

Alkohol in ordinary temperatures, that is, under 60°, diſſolved very little or none, but when heated to 167° it entirely diſſolved the whole of ſome of them. Fourcroy ſays, that it requires nineteen parts of alkohol for the ſolution of one part of this concretion. As the liquor cooled the whole, or very nearly ſo, of the diſſolved matter precipitated; and if the change of temperature was ſlowly and gradually effected, it aſſumed the form of hexangular plates; if ſomewhat more rapidly, it had rather a tendency to ſhoot into ſpicular cryſtals. This hexangular plate may probably be conſidered as the natural and appropriate form of cryſtal of this matter; for in ſome concretions a plate may occaſionally be found with one or two ſimilar angles, ſufficiently diſtinct for obſervation.

Sulphuric ether entirely and readily diſſolved it, and the ſolution was permanent as long as the ether retained its liquid form, but as it evaporated the diſſolved matter remained, and cryſtallizing, generally took its ſpicular modification of form, ſhooting beautifully in radii from different centres on the ſides of the containing glaſs.

Eſſential oils, and particularly that of turpentine, were others of its ſolvents. A portion of a ſolution in this latter having been left expoſed in a ſhallow glaſs pan for a few days of the ſummer, had coated it with a great number of ſmall radiated cryſtalline maſſes, all of which were exactly circular in their outline, and all aroſe from their own central points.

Sulphuric muriatic and oxy-muriatic acids did not, in ordinary temperatures, affect the form, diminiſh the weight, or appear to have received any impregnation. In a boiling heat the ſulphuric acid did more, it blackened and diſſolved it, with the ſame apparent phænomena that it exerts upon vegetable matter, the perfect decompoſition of the concretion, the ſeparation of its carbone, and the extrication of ſulphurous acid gas.

Solutions of ſoda and potaſh did not act upon theſe concretions in the leaſt, and it ſeems to be in the altered relation of this matter to alkalies, compared to that of the bitter principle of bile, that the great difference between them conſiſts.

When theſe concretions were immerſed in ſtrong and pure nitric acid they were immediately acted upon; their aggregation was broken down, the liquor became as it were muddy, and a portion of greeniſh liquid oil collected upon the ſurface; this in time diſſolved, particularly if expoſed in a ſomewhat increaſed temperature, with a very copious extrication of the orange colored fumes of nitrous acid; the liquor became tranſparent; and had its color conſiderably deepened towards that of orange.

This acid ſolution dropped into a large proportion of diſtilled water, gave an immediate precipitation of white opaque membranous films, which ſubſided to the bottom, and could be collected readily to the quantity of the concretion ſubjected to the action of the acid.

This matter, on drying, became hard and friable, and poſſeſſed ſcarce any perceptible bitterneſs of taſte. Being collected to the amount of a few grains, it was tried in various ways. It was not inflammable, like the original matter, but it liquefied, grew black, and, after a red heat, had left only a very ſlight reſiduary cinder. It was immediately ſoluble in ether and in alkohol, and theſe ſolutions, but more eſpecially the latter, had acquired a very ſtriking yellowneſs of tinge, on the evaporation of the alkohol; before the whole of the liquor had paſſed over, it gave a whitiſh pulverulent precipitate, as the reſins do.

On the addition of a ſmall quantity of a ſolution, either of ſoda or potaſh, to this matter, it was immediately diſſolved, and the liquor aſſumed a deep reddiſh brown color; this, when the proportion of alkali was accurate, had alſo a decidedly bitter taſte. An acid added to this colored ſolution gave a white precipitate, which more alkali again diſſolved with aſſumption of the brown color.

The concretion, therefore, after having been ſubmitted to the agency of nitric acid, was eſſentially altered in its characters, and brought into a ſtate much more nearly reſembling that matter which is in bile, combined with ſoda. It had become ſoluble in alkali, with the aſſumption of ſome bitterneſs of taſte, and of the peculiar color of bile, in which relations to the ſame agent it had not previouſly ſtood. The nitric acid, too, had been deprived of a certain portion of its oxygen, for its previouſly white fumes were then converted into orange ones. Independent of this alteration of the acid, the analogy of other phænomena would lead us to the belief that the matter had received a larger portion of this particular principle. The tendency of every ſubſtance to combine with alkalies ſeems to increaſe in proportion to the quantity of oxygen with which they are combined. In the bleaching of linen, for inſtance, this combination is effected before alkalies can act upon or diſſolve the coloring particles, as the uſe of the oxy-muriatic acid, and the effects it produces, have moſt deciſively eſtabliſhed.

But even if the fixation of oxygen be admitted, it may be aſked, whether this be all the change which takes place, and whether the baſe remains unaltered, except in this one particular? If this was all, it ſeemed probable that the oxygenation of this ſpecies of biliary concretion ought alſo to be effected by other, and perhaps by more ſimple and ſatisfactory methods, as by the uſe of oxy-muriatic acid, or its combinations; and this idea would alſo perhaps be favored by conſidering that the original matter is inflammable, and the altered matter not ſo.

With this view I nearly filled a ſmall bottle with oxy-muriatic acid, and added thereto a few grains of this concretion; in order to aſſiſt the decompoſition of this acid I expoſed it to a ſtrong light, which is found, under other circumſtances, to be ſtrikingly favorable to the transfer of its oxygen, and continued the expoſure for three days, the acid was altered, it had loſt its ſuperabundance of oxygen, and had become common muriatic acid; but this liberated oxygen did not appear to have combined with the matter of the concretion, which was not more ſoluble in alkali than before, or altered at all in its relation to ether, alkohol, or other ſolvents of it.

As a difference of temperature might conſiderably influence the affinities of theſe ſeveral principles, I triturated a ſmall portion of this concretion, ſo as to mix it intimately with oxy-muriat of potaſh, and then having added a ſmall quantity of water expoſed the mixture to 212°, for a conſiderable time without apparently effecting this alteration. Another portion of the ſame mixture was left expoſed to light for ſeveral weeks, but this transfer of oxygen had not taken place.

It was farther deſirable, upon the ſame principle, to try the converſe of the former experiments, to endeavour to deprive bile of its oxygen, and ſee whether it was by this means changed into a matter reſembling its concretions. For this purpoſe I mixed bile with water, impregnated with hydro-ſulfure, under various circumſtances and temperatures, but without ſucceſs. There was, after long ſtanding, ſome precipitation of thin films, but it did not ſeem to be analogous to the matter of concretions.

Upon the whole, therefore, there are many reaſons why we ſhould be cautious in admitting the concluſion that the difference between biliary concretion and matter of bile depends ſolely upon the relatively increaſed proportion of oxygen in the latter. If other animal matter did not ſtand to nitric acid in a very ſimilar relation, if other leſs ſuſpicious modes of adding oxygen produced the ſame effect, or if its abſtraction left any thing like concretion, the theory would be perfect; as it ſtands here it is very deficient, but ſtill it correſponds ſo well with various ſtrong analogies, and ſo ſtrikingly explains all that we know of its production and cure, that though I may be condemned for the adoption of a haſty and unfounded opinion, I cannot help preſſing it as a point ſtill deſerving future conſideration.

Some writers have been led, by the ſimilarity of external appearances, to ſuppoſe that this matter reſembled ſpermaceti in its properties. From the previous notices of the relations of the matter of concretions to ſome few ſubſtances, the compariſon between it and ſpermaceti, with reſpect to theſe relations, was eaſy, and in conſequence of the exiſting affirmation it was alſo of conſequence *.

* Annals de Chymie, Vol. VII. p. 189.

Fourcroy has remarked that they differ with reſpect to the temperature, at which they aſſume a liquid form, and ſtates that ſpermaceti fuſes in a heat from 105° to 112°, whilſt biliary concretions remain ſolid at 235°. Each of theſe ſubſtances was ſubmitted to the action of ſulphuric ether, the biliary concretion was diſſolved, and the ſpermaceti remained for a day longer, under the ſame circumſtances, apparently unaltered. Alkohol alſo, when aſſiſted by heat, effected the ſolution of both, and both cryſtallized in radii on the ſides of the containing veſſel as it cooled; but a given quantity of this menſtruum would not diſſolve above one eighth the quantity of ſpermaceti that it did of concretion. As alkalies had not touched the matter of theſe concretions, an equal portion of it and of ſpermaceti were expoſed in a ſolution of potaſh, and the bottles were each placed in a ſlight ſand heat, the latter not only melted, but remained diffuſed through the liquor in the form of ſoap, while the former preſerved its ſolid form unaltered. Spermaceti, too, was differently affected by the ſame nitric acid; it entirely melted, and formed a ſtratum of oily matter, which floated upon the ſurface; on being poured into water this oil concreted, but it ſtill preſerved its original relations; it had not become more ſoluble in alkalies, like the matter of biliary concretions, but remained ſpermaceti ſtill under every circumſtance.

Nor did the concretion more accurately reſemble any of the other animal fats, but ſeemed to be a peculiar and diſtinct matter, which the organization of the liver does in ſome inſtances produce inſtead of its natural and healthy ſecretion.

Another ſpecies of biliary concretion, which there is ground to conſider as a perfectly diſtinct one, is the black and greeniſh black ſort; theſe were either amorphous or lamellated, without the leaſt appearance of radiated or plated cryſtallization.

They were remarkably friable, felt gritty in the mouth, and had no perceptible bitterneſs or other peculiarity of taſte.

They did not inflame, and almoſt generally ſank in water, which was noted both by Bianchi and Morgagni.

Alkohol or water *, even when boiling, acquired no impregnation, and were not altered in their color.

Ether aſſumed a deep green color, but even after a digeſtion of many days with repeated additions, the concretion ſtill ſeemed to retain its original ſtate and color.

The colored ethereal ſolution yielded no cryſtals on evaporation, but an extractive maſs which accurately reſembled bile.

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* I dare not venture, however, to affirm that this is univerſally or even generally the fact, or whether it may ever be ſo at the time theſe concretions are taken from the bladder, and before they are dried and have undergone a long expoſure to the air. Hoffman deſcribes ſome—qui ingentis fuere magnitudinis & mollioris ſubſtantiæ, totam fere cyſtidis implentes cavitatem, ultra dimidium in aqua calida fuiſſe ſolutos. *Med. Rat.* T. IV. Sect. ii. Cap. 2. Sect. vi.—Bartholin alſo, Cent. iii. Ep. Med. 85.

The reſiduary ſkeleton of theſe concretions appeared to be pure carbone in every other reſpect, and on being expoſed in a jar of oxygen gas inverted over mercury, to the focus of a burning lens, it was, with the exception of a ſlight film, converted into carbonic acid gas.

Alkalies diſſolved a conſiderable portion of theſe concretions, and formed a deep brown colored liquor, which, when diluted, had a green tinge.

Nitric acid, aſſiſted by heat, diſſolved them readily, and gave a bright reddiſh brown ſolution reſembling that of bile.

The aſhes of a ſmall portion of this concretion, which had been burnt in the focus of a burning lens, had a little water added to them and received an alkaline impregnation, which was evident from the alteration of paper tinged by the blue color of violets.

In many reſpects, therefore, this ſpecies of concretion gave proofs of its containing actual bile, but they are not compoſed of dried bile alone, for the bare artificial exſiccation of this fluid, however long continued and in a greater heat than it is ever expoſed to in the body, cannot bring it into a ſtate at all ſimilar to this, or even render it inſoluble in water; the diſeaſed change is therefore different in its nature, and mixed with the matter of bile, there appears to be a great but variable proportion of carbone, upon which the peculiarities of theſe concretions depend *.

Independent of the preſence of carbone, the bile itſelf ſeems to have here alſo undergone a change from its natural ſtate beyond what ſimple inſpiſſation can produce, and we have in the ſame bladder the ſeveral gradations of

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* Piccolhominus thought, from their appearance, that they were formed from bile which was burnt in the cyſt like a coal.—Bilis in ea diutius quavis de cauſa commorata exuritur, & carbonis inſtar in calculos ſubnigros convertitur. *Anat. Prælect.* xx. p. 129.

Galen deſcribes a modification of bile which very accurately reſembles the appearance of theſe ſtones.—Ο ἐξ υπεροπλησεως της ξανθης χολης γινομενος, ον τινα και ασφαλτωδη ονομαζομεν δια το ϛιλβειν αυτον ασφαλτου δικην. *Definit.* δ.

natural bile, altered bile as it enters into the compoſition of the concretion, and carbone. May it be inferred from hence that the natural bile does in ſome way or other undergo this alteration in the bladder, independent of the ſtate in which it is ſecreted; and what are the circumſtances determining it? This kind of concretion, differing as it does from the former, has not hitherto been ſufficiently noted or connected with the appearances during life to allow of any reaſoning on the cauſes of its formation.

This concretion then, though it contains a peculiar matter, widely differing from the former, does not contain it in a ſtate of purity, and is therefore rather to be conſidered as a mixed one, and with the ſmall portions I have obtained, the ſame has uniformly been the caſe.

The varieties, therefore, which require to be mentioned relate to the admixtures which are occaſionally found with the former ſpecies, and theſe ſeem to be bile and animal matter in various proportions.

Of the concretions which contain the cryſtallizable matter, thoſe only can be ſaid to contain it pure which are perfectly colorleſs, and this is by no means their common appearance; they are for the moſt part of a brown color, and ſometimes, where they are formed of diſtinct layers, it is deeper in ſome than in others of them. This appearance I conſider as adventitious, and as drawn moſt probably from the coloring matter which the particles carry mechanically along with them at the time of the formation of the concretion from the denſe and brown medium in which they ſhoot. This appeared on expoſing them to ſolution of potaſh, and in ſome caſes, eſpecially where they are recently taken from the bladder to hot water, which extracted and combined with their coloring matter, whilſt upon that which is the baſis of the concretion it had no action, but which remained freed from color, and perfectly whitened; on farther examination this ſeparated matter was found to reſemble bile very accurately.

Another heterogeneous ſubſtance, which conſtitutes a part of many biliary concretions, is animal matter, reſembling in every reſpect dried mucus; this conſtituted the variable quantity of reſidue which was left on digeſting them in ether, which diſſolved both the matter of the concretion and its coloring impurity. It ſeemed more particularly to adhere to and form a coat upon the ſurface, for, on expoſing a perfect concretion to the action of ether, I have often ſeen the whole diſſolved, except a film, which, though thin, ſtill retained the original form of the maſs *.

The chief circumſtance which ſeems to determine the formation of biliary concretions is a life of indolence and inactivity; it matters not whether it has

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* The explanations attached to the plates, will ſufficiently explain their application to what has been here advanced.

been paſſed amidſt the luxuries of greatneſs, or the hardſhips of poverty; and if it be more common in the former, it is perhaps becauſe neceſſity compels the ſubjects of the latter to more perſonal exertion. This appears to be a point of univerſal conſent. They are comparatively much more frequent in women than in men, and in either ſex, eſpecially in thoſe who have paſſed the middle and active period of life. Haller noticed the frequency of their occurrence in criminals, whoſe death had been preceded by long confinement *. They are often found in the gall bladders of oxen, which have been ſtalled during the winter months, and I have reaſon to believe that they occur in a larger than common proportion of maniacs who have been long confined.

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* Opuſc. patholog.

Bianchi remarks the frequency of their occurrence in thoſe who have been ſubject to frequent attacks of gout, and thinks the combination ſo common that he adds, Adeo verum eſt non minorem intercedere conſenſum inter renales calculos & hepaticos quam inter eamdem lithiaſim & podagram. *Hiſt. hep.* T. I. p. 193.

What then are the particular circumſtances of ſuch a mode of life, and how can they be ſuppoſed to operate in the formation of biliary concretions? It implies not only a want of exertion of the muſcular powers, which are obedient to the will, but alſo leſs action of the involuntary ones. The contractions of the heart and arteries are made more ſlowly, while exerciſe may increaſe them ſo as to be almoſt countleſs. The reſpiration is much leſs frequent, and a leſs proportion of oxygen gas is expended by an animal in a ſtate of quietude. The relative ſituation of the liver to the diaphragm, and its participation in the motions of it during reſpiration, is another circumſtance alſo by which it is very probable that its ſecretions are affected. From the experiments upon theſe concretions with nitric acid, I would again repeat that no concluſions can fairly be drawn as to any morbid alteration which takes place in an animal body, but if it can be ſuppoſed to act ſimply by ſupplying oxygen to its decompoſition to the matter of concretions, and thus to bring it nearer to that which is combined with alkali to form bile; it may be aſked whether the deficiency of oxygen in the ſyſtem may not perchance occaſion the ſecretion of a matter containing leſs, and which cryſtallizes inſtead of a matter containing more, and which is, by this means, rendered ſoluble in alkali.

It is probable that climate, and its attendant circumſtances, have a conſiderable influence upon this morbid alteration. As far as I have been able to aſcertain, it muſt be a very rare diſeaſe indeed in hot countries, though the inactivity connected with them might ſeem, at firſt ſight, likely to render it frequent. The bile there has a tendency to run into a different ſtate of alteration. The antients appear to have known little of it, with us it is extremely common; Haller mentions it as remarkably ſo in ſome parts of Germany *, and as far as can be judged

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* Opuſcula pathologica.

from the number of caſes recorded, it muſt likewiſe be frequent in France; but there does not, upon the whole, appear to be ſufficient foundation for any general opinion upon this point at preſent.

Another, and ſometimes a very formidable morbid alteration of bile, often occurs, in which *it is ſecreted in much greater abundance, more aqueous, and certainly, too, exerting more violent effects*, than any quantity of natural bile would do. It is to be regretted that we have no chemical examination of bile, which has occaſioned the conſequences alluded to, on record, and that our knowledge of animal chemiſtry is probably too imperfect, even if we had, to diſcover and to indicate the change which has taken place; as it is we know it only by its effects, and as producing the diſeaſe called *Cholera*, and ſome leſs intenſe varieties of it in many *Diarrhœas*.

Cholera is among the moſt ſudden and violent of all diſeaſes in its attack;

it is rapid in its progreſs, and often fatal in its effects. It ſometimes commences at once, with its characteriſtic ſymptoms, an immenſe vomiting of bilious matter rendered ropy by admixture of mucus, under which form it continues, and a frequent diſcharge by ſtool of a ſimilar matter, attended with pain and tenſion of the whole inteſtinal canal. There is great anxiety, with heat and thirſt, but after a ſhort continuance the ſmallneſs and frequency of the pulſe, the coldneſs of the extremities, the pale hue of the countenance, its clammy ſuffuſion, and the ſpaſms, which firſt attack the calves of the legs, and then become gradually general, threaten the near approach of death; this ſometimes does happen in a few hours, but where it does not, the diſeaſe rarely laſts more than three or at moſt four days. It is ſcarcely poſſible to conceive, without ſeeing, the vaſt difference which a few hours continuance produces in thoſe who, at the beginning of that period, were in the full enjoyment of health and vigor.

The acrimony, and what has ever been called the corroſive power of the matter thrown up, has been noticed by authors, and its color has been mentioned as yellow, green, or black *.

The eſpecial cauſe producing this unuſual action of the liver is the expoſure to high temperatures; hence it becomes an endemic in hot countries, where it attacks in all its violence, but with us it is rarely found, except when a hot ſummer has produced an approximation of our temperature to that of more ſouthern climes.

It is, therefore, from ſuch ſituations in which the morbid varieties of bile, connected with increaſed flow, are found in full perfection and abundance, that we muſt expect a ſatisfactory examination of their qualities. It is rather remarkable that I have not been able, through the whole of the laſt ſummer,

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* Hoffman Med. Rat. Sect. ii. cap. 8.

to obtain the bile of any patient who had clearly fallen a victim to it.

Heat will, even when artificially applied, conſiderably affect the ſecretion of bile. It has not unfrequently been purpoſely employed upon myſelf, and has uniformly produced its effect, but the matter brought up has been yellow in its color, and has had the common taſte of natural bile.

Habit, too, has conſiderable influence over the ſecretion of the liver, and when a hot climate has occaſioned a few attacks of increaſe in its quantity, it will readily be excited afterwards even by leſs cauſes. On the inhabitants of the Eaſt and Weſt Indies reſident here, I have noticed more frequent derangement from this ſource than in the natives, and that in temperatures much leſs than they have been accuſtomed to, and which ſeems only explicable under this idea. Bilious diſeaſes, as they are properly termed, are one great bane of all who have paſſed their lives in warm climates, and I believe they are leſs frequently attended by organic diſeaſe than is commonly imagined.

The leſſer attacks of this affection, which ſeem only to differ in degree from the higher, conſtitute a very common claſs of autumnal complaints in this country. They may be properly called *bilious Diarrhœas*, as proceeding certainly from the ſtate of the biliary ſecretion, and being attended with the ſame abdominal pains, the ſame depreſſion of ſtrength, but not with the tendency to vomit, which makes cholera ſo much more formidable.

In aſcertaining the various cauſes of diarrhœa, much information, and, in many inſtances, much practical advantage, may be drawn from the appearance of the ſtools. They may, for inſtance, when bile is the cauſe, put on the ſeveral ſhades of color which we know this ſecretion to be able to aſſume. Of the cauſes of theſe ſhades we know ſomewhat, and this knowledge may modify the remedies to be employed ; ſo too the clay colored ſtools of jaundice add aſſurance to other ſymptoms; the greaſy dejections which conſtitute colliquative diarrhœa; the mucous and bloody ones of dyſentery; and thoſe which contain pus, and are conſequent to the rupture of an abſceſs in the canal; are all of them ſtriking characteriſtics of their ſeveral diſeaſes, and amply repay the inconveniences of their examination.

The bile contained in the bladder is ſometimes found to be much *more aqueous*, *leſs tenacious*, *leſs colored*, *and leſs bitter*, than natural; upon this change I know not that any particular ſymptoms or inconvenience depend. It is generally connected with diſeaſes of debility, where the circulation is languid, and all the ſecretions are imperfectly formed, ſuch for inſtance as chloroſis [*].

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[*] De Graaf mentions bile entirely ſerous, and tinged with ſo ſlight a yellowneſs that linen immerſed in it ſcarcely received any color therefrom. Obſ. 10.
Van Swieten Comment. in Boerhaave, Sect. 935.

When from impaction of a concretion, or any other cauſe, ſuch as ſchirrus in a particular local ſituation, each of which inſtances have occurred to myſelf, the paſſage of the bile from the liver into the gall bladder is prevented, this receptacle is not in general found empty, but *diſtended* to about its uſual ſize, or ſomething more, *by a thick colorleſs mucous fluid*, which is commonly coagulable into a firm maſs by heat, by acids, and by alkohol; and except that the coagulum ſeems denſer, it very accurately reſembles ſerum. This fluid is purer from any tint or admixture of bile, in proportion as the obſtruction has exiſted longer, and it ſhould appear that it is to be conſidered as the appropriate and unmixed ſecretion of the internal ſurface of the gall bladder*. But I once ſaw a re-

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* Ad ignem coagulabatur inſtar albuminis ovi. *Van Swieten Comm.* Sect. 950.

This appearance is by no means uncommon, various authors have deſcribed it, and eſpecially Gliſſon, Anat. Hepat. cap. 39, who found contained in the gall bladder markable deviation in this liquor from what I thought to be its uniform characters, though as I did not at the time ſuſpect the difference, I neglected keeping more than about half an ounce of the contents, which amounted in the whole to a full three ounces. It had about the uſual color of ſerum, with a very ſlight ſweetneſs of taſte, without any bitterneſs; it felt tenacious between the fingers; it ſeemed to alter the color of delicate vegetable blues more than the admixture of its own yellow color alone would have done; neither heat, nor alkohol, nor acids, nor matter of tan, produced the leaſt turbidity or alteration in it. This, therefore, did not anſwer to the characters of ſerum or of jelly, and what was it? probably an admixture of mucus with water, which appears beſt to anſwer to the deſcription I have given. This, therefore, may, I think, be conſidered as a

humorem ſeroſum pallidiuſculum, minime amareſcentem, ſed inſipidum potius dulcique proximum.

ſecretion altered from its uſual ſtate, and therefore a diſeaſe, though not in itſelf of much importance under any point of view.

Oppoſed to the more aqueous ſtate of the bile it can, I think, in certain caſes be proved that *a matter is ſecreted* by the veſſels of the liver *of a much greater denſity* than is natural, ſtill retaining the yellowneſs of bile, and by its accumulation giving the general yellow color which is frequently found in diſeaſed livers. The depoſition of this altered matter is generally alſo attended by the ſecretion of a certain quantity of common bile, for I have never ſeen it where the gall bladder was not as full as natural, and the contents of the inteſtines of a natural color. No mechanical obſtruction then to the free paſſage of the bile exiſts in this inſtance, nor has any been found in the larger ducts, or at their entrance into the duodenum, yet jaundice is its uſual concomitant. Of this matter, too, it does not appear that any portion enters into the biliary ducts themſelves, or does more than accumulate in the liver. On what then does the jaundice in this caſe depend? apparently not upon the abſorption of the bile itſelf, but more probably upon that of this diſeaſed yellow matter, which, on account of its deviation from a fluid ſtate, the biliary ducts cannot convey away. What are the peculiarities of this matter I know not, or whether it approaches at all to the nature of concretions, but it has ſeemed to me to be a diſeaſe very often connected with the internal uſe of the ſeveral modifications of alkohol.

It is impoſſible to mention this pernicious and general cuſtom without noticing how large a proportion of modern diſeaſes, and theſe the moſt fatal, is fairly attributable to it; and lamenting the policy which, by tolerating its preparation, ſacrifices the health and morals of the people to the revenues of the ſtate. The abundant follies and luxuries of life are fair and proper objects of taxation, and a good citizen will offer up a ſhare even of his neceſſaries for the ſafety and exiſtence of a government he cheriſhes, without repining; but the vices of mankind require actual puniſhment to repreſs them effectually, and it is very difficult to perceive the juſtice of a decree which throws a man's bones with ignominy into the highway for taking a ſmall portion of arſenic, and permits another to paſs peaceably and with credit to his grave, who has wilfully ſwallowed enormous quantities of a poiſon, ſlower indeed in its operation, but no leſs certain in its effects.

There is alſo a ſtate of the bile which appears to depend upon a vitiated ſecretion, and which conſtituted the principal modification of the *atrabilis*, deſcribed by the ancients, and was by them well deſcribed, and by no means confounded with evacuations diſcolored by blood.

Of its exiſtence I am ſure, though, from the fæcal matter with which it ſubſiſts in the ſtools, I have had no opportunity of endeavoring to aſcertain in what the alteration depends. The ſtools have a deep black color, with a ſoft conſiſtence, and greaſy ſort of appearance. Theſe are connected with great torpor in the functions of all the abdominal viſcera, and amongſt the reſt with coſtiveneſs. There is, too, a cloſe relation between theſe altered fæces and biliary concretions, perhaps both depend upon ſome modification of the ſame diſeaſe. Thoſe in whom I have met with this appearance have often paſſed their ſtools white and clayey, and have been ſubject to occaſional attacks of jaundice, attended with conſiderable pain.

From the effect of various acids upon bile out of the body, in producing a green color of it, and from the ſimilar appearance which is often found in the fæces, we are led to ſuppoſe that the ſame cauſe produces the effect in either inſtance; I have added the gaſtric acid to yellow bile, with a view to theſe effects, and have found the green muddy color, and flocculent precipitation of the ſerous part, to follow in the ſame way as when other acids were uſed.

This then is to be conſidered as a morbid alteration produced in the bile, by the application of an extraneous matter, after it has left its ſecreting organ, and nurſes are well aware of the ſeveral appearances connected with it, from obſerving the ſtools of young children.

Among the diſeaſes of this ſecretion we may reckon the *preſence of blood in the biliary canals*, which diſſections have occaſionally aſcertained to be the fact [*]. This is one ſource of hæmatemeſis, and in hard drinkers not an uncommon one. Morgagni mentions an hæmorrhage from the internal ſubſtance of the liver through the biliary ducts into the inteſtinal canal, and occaſioning a copious diſcharge of blood both from the ſtomach and inteſtines. I am acquainted with one inſtance where this ſeemed to be the caſe. From previous habits an affection of the liver had been long ſuſpected, and after ſome duration of uneaſineſs in the right hypochondrium an attack of nauſea, with ſhivering and fainting, was followed by a diſcharge of a large cake of blood from the ſtomach, and the ſubſequent ſtools were deeply colored by blood alſo; this was but a ſingle attack, nor was there afterwards any reaſon to ſuſpect ſuch an affection of the ſtomach as the diſcharge of ſuch a quantity of blood from its coats would have produced; and in this caſe it was attended by much temporary relief in the ſtate of general health.

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[*] Portal Memoires de l'Academie, p. 160.

LASTLY, there remain for conſideration *the ſeveral modes of treatment* proper to be adopted in the diſeaſes which have been mentioned. Into theſe I ſhall not attempt to enter minutely, but rather ſtate thoſe general principles which my own experience has impreſſed upon my mind.

Of jaundice the treatment will be as various as its cauſes, and will conſiſt in the removal of the obſtructing power, whatever it may chance to be. The nature of this then is a firſt and moſt eſſential point for inveſtigation.

When the ſymptoms favor the ſuppoſition that the jaundice ariſes from the impaction of a biliary concretion in the duct, our endeavors are to be directed to facilitate its paſſage into the inteſtinal canal. This is beſt done by the uſe of thoſe means in the firſt place which are known to abate increaſed action of muſcular fibres; and in the next of ſuch as deſtroy irritability, in which way the exiſting contraction may be overcome, and the ſuſceptibility of the duct to the extraneous body be diminiſhed. It is only in the more violent caſes that any active practice becomes neceſſary under the firſt of theſe indications, but ſuch are by no means unfrequent, and in them I am ſure that veneſection is of eſſential ſervice; it ſhould be performed once in rather a large quantity and no more, for in the relaxation of muſcular contraction and diminution of increaſed action the effect will be not in proportion to the quantity loſt upon the whole, but to the celerity with which that quantity is taken away, and twenty ounces of blood loſt at once will be much more efficacious than forty taken at repeated times, even though the intervals be but ſhort between each.

Immerſion in a warm bath is a practice commonly employed upon a ſimilar principle, but I have noticed that its temperature is in general undefined, and the length of its continuance not ſufficiently enforced. In order to produce the moſt powerful relaxant effects its temperature ſhould be from 100° to 110°, and certainly not leſs than the lower of theſe degrees; and the immerſion ſhould be continued till an incipient faintneſs is produced, which, whether it take place after a longer or a ſhorter time, is the beſt criterion to regulate its duration, for where it has not followed, the bath has not ſeemed to me to have any good effect. This may be repeated according to the violence of the ſymptoms, and the feelings of the patient will, while the fit continues, lead his own wiſhes to a repetition. I ſhall here once for all ſpeak of the utility of warm bathing in various diſeaſes of the liver, either induced by alkohol, or reſidence in hot climates; in both of theſe caſes the frequent uſe of it has been commonly recommended, and it has appeared to me to be ſerviceable, but here the temperature ſhould be under 100°, or even nearer to 90°, ſo as to give the ſenſation of what is called luke warmth, and it ſhould never be continued ſo long as to occaſion faintneſs. I think, too, in ſuch caſes that ſea water has infinite advantage over common water; and as I know, from experiment, that ſaline impregnations are abſorbed into the ſyſtem, and that ſufficient portions to be rendered ſenſible paſs out of the body by the kidneys, I would hazard a ſuggeſtion that nitre more eſpecially, and in ſome caſes other ſalts, might be advantageouſly employed in this way; at preſent I confeſs that we have no certain data with reſpect to medicated baths, but to me it ſeems a ſubject well deſerving of patient and accurate inveſtigation. The only object at preſent looked to is temperature, and people are in the conſtant habit of travelling very many miles for the purpoſe of getting water at 118° at Bath, 80° at Buxton, or 70° at Matlock, without reflecting that hot water is the ſame whether it be drawn from the bowels of the earth or the ſpout of a tea kettle, and that as far as analyſis has gone there is no peculiarity in the matter impregnating any of theſe waters which can give them a juſt title to preeminence. If experience be required in ſupport of this opinion, I will quote that of the accurate Dr. Saunders*, upon which foundation he ſtates that the waters of Bath, Briſtol, and Buxton, have no powers ſuperior to thoſe of common pump water, heated to the ſame temperature, and I can give it the confirmation of ſome caſes which have fallen under my own notice.

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* Treatiſe on the Liver.

The exhibition of opium, chiefly in its ſolid form, is often combined with the former relaxant remedies moſt advantageouſly, inaſmuch as it allays the diſtreſſing violence of pain, and its uſe is not prohibited by any inflammatory ſymptoms. When it is to be employed it is not ſufficient to adminiſter ſmall or even ordinary doſes, which are too little to produce any definite effect, but rather to give a large one in the firſt inſtance, and to follow this up by the repetition of ſmaller at certain intervals, which will prolong the powers of the medicine, and ſometimes the concretion will paſs while the patient is under its influence.

Repeated emetics, and eſpecially ipecacuanha, have been recommended as aſſiſting the paſſage of the concretion, and ſhortening the complaint. It is moreover ſtated, on the higheſt practical authority [*], that it may be given under the ſevereſt intenſity of pain, which it will tend rather to allay than to aggravate. Now it happens that not only nauſea but actual vomiting are commonly among the moſt diſtreſſing ſymptoms we have to combat, and that it is unneceſſary to excite them artificially farther than as it may be thought adviſeable to ſecond medically the proceſs for their expulſion, which nature herſelf eſtabliſhes. But without entering into the theory of their uſe, I think when they have been given that the duration of the diſeaſe has not been ſhortened, or any ſingle ſymptom alleviated in its violence. It is true that my recollection does not furniſh me with any inſtance of injury produced by them, but I have always thought them ſuſpicious, and that any propulſion of the concretion by mechanical preſſure, which is all that in the firſt inſtance they can effect, was rather to be avoided than promoted, and that it was better to depend upon thoſe methods which rather tended to diſpoſe the ducts to relaxation, and in this way to favor its paſſage.

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[*] Heberden, Med. Tranſ. Vol. II. p. 610.

The inſtantaneous relief which follows the entrance of the concretion into the duodenum marks moſt decidedly when that takes place. It may be doubted whether any farther aid be neceſſary, perhaps it is not poſitively ſo, but it ſeems advantageous to preſerve an open ſtate of the bowels by means of mild purgatives, ſuch as oil and manna, for ſome days, not only for the purpoſe of carrying the concretion out of the body, but alſo, by the diſcharge they occaſion, to aſſiſt as much as we can the change and renewal of the aqueous fluids contained in the veſſels, and the conſequent removal of the bile which they hold in ſolution.

It is of much importance, in the next place, to conſider how far we may be able to prevent the future recurrence of theſe attacks, which is always to be ſuſpected, and whether it be poſſible to effect the ſolution of theſe concretions when they are contained within the gall bladder. Theſe are points which do not admit of abſolute demonſtration, and which one would perhaps be rather diſpoſed to deny; but with reſpect to the powers of medicines this reaſoning is not juſtifiable, and it is better to uſe any means, that are recommended upon tolerable authority, than to leave a patient to ſuffer without endeavoring to aſſiſt him, or to give up the chance of ſucceſs becauſe the uſual methods fail.

Various medicines have not only been propoſed, but confirmed by the reported experience of ſome, which act as ſolvents upon the more common concretions out of the body; of theſe ether and oil of turpentine are the chief, and the combination of them was firſt employed in France[*], and its effects ſpoken of in high terms. Alkohol and ſome eſſential oils have been referred to as eminently uſeful, by a practitioner of our own country[†]. Of the powers of theſe I know nothing from experience, but a priori it may be juſtly queſtioned whether a ſufficient portion of that ſmall quantity, which is taken by the mouth, can ever reach the gall bladder, through the mazes of the circulation. If, however, the generally received ſtatement be true, that the biliary concretions of ſtalled oxen, which are generated during their confinement of the winter, diſappear in the ſummer, when they have the enjoyment of freſh paſture and exerciſe in the open air, it is to be inferred that ſome of theſe altered circumſtances are ſufficient to effect their removal even when they have been in actual exiſtence. Practitioners, who have thought that the whole difference depended upon the

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[*] This combination is ſaid to have been uſed ſucceſsfully, and in unequivocal caſes, by ſome French writers; ſome of their teſtimonies may be found in the collection of the Academie de Medecine, Vol. I. p. 288; and the following general obſervations on its theory and mode of adminiſtration are from the Elemens de Chymie, publiſhed at Dijon, in 1778, Vol. III. p. 322.

La volatilite de l'ether ne permettant pas d'eſperer qu'on pût le faire parvenir ſeul juſqu'à ces concretions, il falloit trouver encore une autre ſubſtance qui s'unit a lui, de maniere à le rendre un peu plus fixe, ſans enchainer ſon action; nous avons reconnu que l'huile eſſentielle de terebinthine rempliſſoit parfaitement ces vues; le melange de ces deux fluides, a parties egales, diſſout meme a froid, tous les calculs du foie, il ne laiſſe que la petite portion de terre calcaire qui entroit dans leur compoſition & qui, une fois deſaſſemblée, peut aiſement s'echapper par les conduits de la bile, les heureux effets en ont déjà ete conſtatés par pluſieurs obſervations.—On le prend tous les matins a la doſe d'une cuillerée a café, il eſt d'une ſaveur rebutante mais on peut le rendre moins deſagreeable, en y ajoutant quelques gouttes d'une autre huile eſſentielle. Deux malades qui ont fait uſage de ces remede, ont rendu par le bas de la terre calcaire, qui formoit la baſe des concretions, & meme des calculs qui avoient probablement aſſez perdu de leur volume par la diſſolution pour paſſer ſans irriter les conduits.

[†] Dr. White, of York, ſays that he has uſed ſolutions of eſſential oils in alkohol, with great ſucceſs; he ſeems,

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however, to wiſh to keep the particulars of his practice ſecret; for he only mentions the fact generally. *Eſſay on Diſeaſes of the Bile*, &c. Second Edit. 1777.

One would almoſt think that Hippocrates had aſcertained the utility of a ſimilar practice from experience, when he mentions a ſpecies of jaundice which is to be treated οινω οινωδει και ασσα ερυθροτερον ποιει τον ανθρωπον τυποισιν. *De Locis.*

alteration of their food, have endeavored to imitate it by giving largely of the freſh juice of graſs*, &c. and, according to their reports, with the greateſt advantage. But it ſhould likewiſe be remembered that among theſe altered circumſtances muſcular exerciſe in the open air is to be ranked, which, if we look to the habits of thoſe who are moſt eſpecially diſpoſed to this diſeaſe, is not to be paſſed over lightly. On ſuch exerciſe, and eſpecially riding on horſeback, I have always laid particular ſtreſs, and I believe it has been uſeful. On the recommendation of diluted nitric acid, as an internal remedy in ſome diſeaſes of the liver, I was induced to embrace an opportunity of uſing it in a patient who was ſubject to frequent attacks of jaundice from biliary concretions; he has improved in his health, and remained free from the complaint from the time of his uſing it, which he has now done pretty ſteadily, in the proportion of one drachm to a pint of diſtilled water daily, for about eight months; from this caſe as a ſingle, and that an equivocal one, no inference can fairly be drawn, but the adminiſtration of acids in certain caſes of jaundice is by no means a new practice, and the report of Baglivi may ſtrengthen the probability of their being uſeful.

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* Videntur Gliſſonii obſervata evincere quod hyemali tempore in bobus natæ incruſtationes calculoſæ vaſorum, ſolvuntur denuo dum verno tempore recens gramen paſcuntur armenta.

Ante multos annos hominem curavi ab hoc morbo qui quotidiano labore ſibi & ſuis victum parare coactus expenſis remediorum impar erat: ſimul tamen conſtantis animi & recuperandæ ſalutis avidiſſimus: hinc promittens curationem facile perſuaſi illi ut ſolo gramine viveret. Decoquebat magnam quantitatem graminis in aqua pura, & decocto melle edulcorato, utebatur pro potu communi; tenerum gramen verno tempore pullulans, vel & poſt primam ſectionem renaſcens, incoquebat carnium juſculo, illoque ſolo fere utebatur cibo.—Sanatus autem fuit a pertinaciſſimo ictero ſola hac methodo, & vidi illum pluribus annis poſtea incolumi ſanitate frui. *Van Swieten Comment.* Sect. 950.

The jaundice which attends occaſionally upon ſpaſmodic affections is not for the moſt part of long continuance,

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* Acidulas in Ictero a pluribus laudatas vidi authoribus. *Baglivi Prax. Med.* Lib. I. Cap. 9.

the cauſe of obſtruction ſoon ceaſes to act, and it is enough that remedies, ſuited to prevent the recurrence of the original diſeaſe, be employed without attending to this particular ſymptom.

Among the cauſes of this derangement of the courſe of the bile, I have ventured to rank general fullneſs of the veſſels of the liver from whatever cauſe ariſing. If it attend hepatitis relief muſt be ſought from blood letting, no other method can remove it; probably the ſame means would produce the ſame relief where it accompanies phthiſis, if it could be juſtifiable to employ a practice for removing a ſymptom which would ultimately increaſe the original diſeaſe, and this has always ſeemed to me to have been unequivocally the caſe where bleeding had been uſed in the more advanced ſtages of phthiſis.

In that ſtate of the liver which produces jaundice towards the end of our intermittent fevers, mercury is the beſt and only remedy. Calomel in ſmall doſes is the form under which it is commonly employed with us, and it ſeems, in this and ſome other hepatic diſeaſes, to act moſt powerfully. In intermittents of long ſtanding, and which can be aſcertained by examination to be connected with this affection of the liver, though not in ſuch a degree as to produce jaundice, I have often ſeen the bark alone compleatly inert, and when it has afterwards been combined with calomel the diſeaſe has readily yielded.

Where ſchirrus of the ſubſtance of the liver, or neighbouring parts, operates mechanically by its preſſure upon the ducts, and occaſions jaundice, it is more likely to prove the ſource of permanent miſchief than any other cauſe, as our means of relieving it are leſs effectual. In the true tubercle of the liver, which begins with induration, and afterwards paſſes from thence to ulceration, the efficacy of any medicine is very doubtful; even mercurials, when given in large quantities, and under any form, have not ſeemed to me to produce any decided or permanent advantage: ſometimes this diſeaſe is connected with the uſe of alkohol, but it is not the neceſſary or indeed common conſequence of it.

If it be admitted that torpor of the inteſtinal canal, and accumulation of mucus in the duodenum can obſtruct the departure of the bile, and thus occaſion jaundice, as it ſeems to do in young children, the employment of any certain and active purgative will be ſufficient to remove it; calomel and jalap are thoſe which are eſpecially ſuited to this indication, and the former may be given in very large doſes without inconvenience, indeed ſuch are generally neceſſary. It is well alſo to perſevere after its action in the uſe of ſmall quantities of rhubarb, mixed with ſpice, and ſometimes the occaſional repetition of the purgative is proper. If I could not ſucceed by any common means in exciting the inteſtines into action I would have recourſe to electricity, which I have ſometimes ſeen ſerviceable in this way, and eſpecially ſo in one inſtance where ſmall electrical ſhocks through the abdomen of a child produced motions when its life had been previouſly deſpaired of.

I have mentioned a peculiar ſtate of liver which I have thought eſpecially connected with dram drinking, where the ſecretion itſelf ſeemed to be vitiated, and eſpecially ſo with reſpect to its denſity. In this our means of relief are more certain, and the operation of medicines more aſcertained. I think that mercurials are here injurious, and ought never to be given; but in the earlier ſtages of the complaint the diſeaſed action in which it conſiſts may be ſtopped by the ſteady and regular uſe of bitter and warm purgatives, a mixture of the infuſion of gentian with that of ſenna anſwers this purpoſe better than any other which I have ſeen. In the more advanced ſtages I think, too, the nitric acid will be found as uſeful as mercury is injurious; at preſent I have in my own mind experience enough to juſtify me in recommending it to notice, though not ſufficient to enable me to ſpeak with preciſion as to its powers. In conjunction with theſe means a perfect reſtriction from the uſe of alkohol, with great regularity as to modes of life in every reſpect, are to be ſtrictly enjoined; perhaps the firſt of theſe points is rather to be wiſhed than expected. I have ſeen very many of the evils ariſing from this ſource; I have witneſſed the bodily ſuffering, and mental horrors which flow from it; but I never yet ſaw the man who had once eſtabliſhed himſelf as a drunkard poſſeſs ſufficient reſolution to forbear the practice.

In the diſcoloration of the fæces, which reſembles the *Atrabilis* of the ancients, which I have conſidered as ſtrikingly connected with biliary concretions, and in the caſes to which I allude, is attended with great torpor of the inteſtinal canal, the occaſional uſe of rhubarb, with ſpice and grateful bitters, ſo as to keep the bowels regular, is of much advantage. Exerciſe, eſpecially on horſeback, is alſo of importance; and I believe, too, that the nitric acid may be here employed with ſome probability of ſucceſs.

It may, perhaps, require ſome apology on the ſcore of precipitation, that I have thrice mentioned, and perhaps more ſtrongly than I ought, a remedy of ſuch late introduction as nitric acid, particularly as it has not, as far as I have ſeen, fulfilled the character given it by its firſt introducers, as an effectual ſubſtitute for mercury in the cure of the venereal diſeaſe; in many other inſtances I have found it a uſeful medicine, and of ſuch I have ſpoken, wiſhing it however to be underſtood that I acknowledge the inſufficiency of my own preſent experience for eſtabliſhing its character.

In jaundice generally it has been thought worth while to endeavor to obviate the inconveniences ariſing from the abſence of bile from the inteſtines, by the adminiſtration of bitters of various ſorts, which might act as ſubſtitutes for it. That in jaundice the functions of the ſtomach and inteſtines are deranged is moſt true, and alſo that bitters do ſtrengthen and improve their powers, and in this way do good; but it remains to be proved whether they do more than this, and whether they can perform the office of bile in any way: they certainly do not relieve thoſe general ſymptoms of depreſſion, and other inconveniences which rather ſeem to depend upon the preſence of bile in the blood than its abſence from the inteſtines. Under the ſame impreſſion that bile was neceſſary in the inteſtinal canal, ſome practitioners have recommended the uſe of inſpiſſated ox bile in caſes of jaundice. I have given it very frequently without the leaſt manifeſt advantage, as far as twenty grains of the extract thrice a day, which muſt have been an ample ſubſtitute as to quantity for the natural bile.

The *enlargement* of the gall bladder from accumulation of bile in it does, as I have ſaid, appear to depend upon a diſeaſe of its coats analogous to paralyſis. The French ſurgeons* have occaſionally ſucceeded in forcing the bile thus contained into the inteſtines, by preſſure applied externally; this, however, is by no means a common caſe, though ſome authors ſeem often to have met with it: if its exiſtence in any caſe was aſcertained, it is probable that the paſſage of ſmall electric ſhocks would be attended with advantage.

In the treatment of *Cholera* the mildeſt practice has uniformly appeared to be the moſt ſucceſsful. It is certainly uſeful, in the firſt inſtance, to employ means to clear the ſtomach of its immediate contents, but no more violent emetic than common water, a little warmed, can be given with ſafety: there is ſufficient irritability in the ſtomach and bowels to occaſion action of them on the application of the mildeſt ſubſtances; hence the more violent ones are at beſt uſeleſs, and they do not even ſeem to poſſeſs this negative merit, but to do actual injury by increaſing that tendency to action which already ſubſiſts too ſtrongly. After this has been effected opium is to be given in ſmall doſes, till the ſtomach and bowels have returned from its influence to a ſtate of quiet, but in this tendency to derangement in them even opium itſelf is often rejected, and it is, therefore, well to endeavor to obviate this inconvenience by giving it in the ſmalleſt poſſible bulk, as in pills of half a grain each, and repeating theſe after ſhort intervals, rather than in a liquid form, and even where theſe precautions have failed, I have ſometimes effected the retention both of it and ſmall portions of nouriſhment, by giving them while the patient was immerſed in a warm bath.

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* Memoires de Chirurgerie, Vol. II.

In the *milder modifications of this diſeaſe*, which form one claſs of the prevailing autumnal complaints in this country, opium is the remedy upon which we chiefly rely; it is proper, however, in theſe caſes, previous to its exhibition, to give ſome gentle purgative: rhubarb with aromatics beſt anſwers this purpoſe, and the opium is afterwards combined advantageouſly with mild aſtringents.

When the immediate violence of theſe attacks is checked it is neceſſary to employ ſome means to remove their conſequent debility, and to ſtrengthen the inteſtines, eſpecially ſo as to prevent a return of the complaint. The bitters have all been uſed for this purpoſe, but of late years colombo has been received into practice, as being more particularly adapted to bilious diſcharges than any of the others. The tincture is the beſt form under which it can be given, and I am much in the habit of adding it to a ſtrong infuſion of Simarouba, which I conſider as the beſt tonic we poſſeſs in a weakened ſtate of the bowels. To this general plan the occaſional adminiſtration of ſmall doſes of rhubarb may be added with advantage, and the uſe of Seltzer water, either natural or artificial, as a common beverage; than this latter nothing is more grateful to an irritable ſtomach.

In this country, too, we have the ſatisfaction to find that ſuch methods of treatment are ſucceſsful in removing theſe moſt depreſſing of all diſeaſes, whilſt in warmer climes the rapidity of their progreſs very commonly baffles all the efforts of art, and they deſtroy life in the ſpace of a few hours.

Where *habit* renders the increaſe of biliary ſecretion a common and troubleſome occurrence, as is the caſe eſpecially with many in this country who have paſſed a part of their lives in either of the Indies, or any hot climate, much may be done by a regular and ſteady perſeverance in a courſe of medicine: during the violence too of the bilious attacks relief can almoſt always be given, and ſometimes this may be effected by methods different from thoſe employed in common practice. It once happened to me to ſtop a violent vomiting of green bilious matter, connected with an early ſtate of pregnancy, and which had continued under aerated draughts with opium and various other medicines, by the adminiſtration of kali præparatum alone, without the addition of any acid, and there is reaſon to believe that this practice may be often uſeful in green vomitings from other cauſes, though experience has not hitherto ſanctioned its application. One point of a general plan upon which, in theſe habitual returns of bilious affections, I have placed great reliance, is the regular uſe of ſome mildly cathartic mineral water, and if it contained ſome iron ſo much the better; ſuch waters are common in this country, and eſpecially about London, ſo that there is no difficulty in obtaining them. Thoſe of Cheltenham I have ſeen of great ſervice, and I think that from Godſtone, in Surry, likely to anſwer this purpoſe as well, or perhaps better than any, indeed becauſe at the ſame time that it is effectual, it is remarkably pleaſant to the taſte, and its uſe is therefore perſevered in without inconvenience. I have taken ſome trouble in making an accurate analyſis of this water, which hereafter I may probably publiſh. To this it will ſometimes be neceſſary to add ſmall quantities of ſome bitter tincture, eſpecially that of colombo, and a ſtrict attention to regularity of diet, which ſhould in a great meaſure conſiſt of eaſily digeſtible animal matter, muſt be enforced. In our endeavors, however, to eſtabliſh any plan which is to be continued for a length of time, we muſt yield ſomewhat to the comfort of the individual, and the eſtabliſhed practices of ſociety, for without this no courſe of medicine will be followed farther than for the removal of immediate ſuffering.

The *aqueous ſtate* of the bile is rather a ſymptom than a diſeaſe, as it is connected with that general debility which affects the ſtate of all the fluids of the body. The employment of thoſe means which are ſufficient to remove the original diſeaſe will alſo reſtore its natural characters to this ſecretion alſo.

FINIS.